MEETING GLOBAL BUSINESS INFORMATION REQUIREMENTS WITH ERP SYSTEMS FOR IMPROVED BUSINESS PERFORMANCE

A thesis submitted in fulfilment of the requirements for the degree of

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To

Thulasi and Paneetha

with all my love.

Declaration

I certify that except where due acknowledgement has been made the work included in this thesis is that of the author alone. This work has not been submitted previously, in whole or in part, to qualify for any other academic award. The content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program. Any editorial work, paid or unpaid, carried out by a third party is acknowledged, and, ethics procedures and guidelines have been followed.

Signed: ______________________ On: _____/____/_____

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List of Abbreviations

AFTA	Asian Free Trade Area
AGFI	Adjusted Goodness of Fit Index
AMOS	Analysis of Moment Structures
ANOVA	Analysis of Variance
ANZSIC	Australian and New Zealand Industry Classification
ATIN	Accurate and Timely Information
AUD	Australian Dollar
AVE	Average Variance Extracted
BPO	Business Process Outsourcing
BSC	Balanced Scorecard
CA	Co-alignment
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CIN	Consolidated Information
CIO	Chief Information Officer
CM	Constrained Model
CR	Critical Ratio
CUSP	Customer Performance
DATIN	Deliver Accurate and Timely Information
DCIN	Deliver Consolidated Information
DF	Degree of Freedom
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
ERPSC	Enterprise Resource Planning Systems Capabilities
EU	European Union
FINP	Financial Performance
GBIR	Global Business Information Requirements
GBPER	Global Business Performance
GBPIN	Global Business Process Information
GM	General Motors Corporation
GOF	Goodness of Fit

GSBU	Global Strategic Business Units
GSCIN	Global Supply Chain Information
HP	Hewlett-Packard
IBPP	Internal Business Process Performance
ICT	Information and Communication Technologies
IGBPIN	Integrate Global Business Process Information
IMF	International Monetary Fund
IS	Information System
IT	Information Technology
KMO	Kaiser- Meyer Oklin
LGP	Learning and Growth Performance
MGCFA	Multi Group Confirmatory Factor Analysis
MGSCIN	Manage Global Supply Chain Information
MI	Modification Indices
ML	Maximum Likelihood
MLIN	Multi Level Information
MPIN	Multi Purpose Information
MRI	Magnetic Resonance Imaging
MRP	Material Requirements Planning
NAFTA	North American Free Trade Agreement
PC	Personal Computer
R & D	Research and Development
RFI	Relative Fit Index
RMSEA	Root Mean Square Error of Approximation
SAFTA	South Asia Free Trade Agreement
SAM	Strategic Alignment Model
SBU	Strategic Business Unit
SEM	Structural Equation Modelling
SFL	Standardised Factor Loading
SIN	Secure Information
SMC	Squared Multiple Correlations
SME	Small and Medium Scale Organisation
SMLIN	Support Multi Level Information
SMPIN	Support Multi Purpose Information

SPSS	Statistical Package for Social Science
SRC	Standardised Residual Covariance
SRMR	Standardised Root Mean Square Residual
SRW	Standardised Regression Weight
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TF	Totally Free
TLI	Tucker Lewis Index
TSIN	Transmit Secure Information
UCM	Unconstrained Model
UN	United Nations
URL	Uniform Resource Locator
US	United States
USA	United States of America
USD	United States Dollar
UTC	United Technologies Corporation
WTO	World Trade Organisation
WWW	World Wide Web

List of Publications

Journal

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1) Rajapaksha, M., 2010, ‘Aligning ERP Systems to Global Businesses’, Proceedings of the Fourteenth Pacific Asia Conference on Information Systems, Taipei, Taiwan, July 8-9, 2010.

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Abstract

This thesis explores global business performance outcomes as a result of aligning ERP systems capabilities to global business information requirements. Global business is a network of interconnected organizations that have multinational operations and exchange finished goods, raw materials, services, information, knowledge, skills and capital across national boundaries. It is a new business trend in which organisations from all industry sectors capitalize on cheap labour, low cost capital, unique resources and new market opportunities in the global economy. However, global business management entails unique information requirements from strategic business units (SBSs) operating in different parts of the world.

Global business information requirements include: 1) multi-level and multi-purpose information from global SBUs; 2) accurate and timely information; 3) consolidated information; 4) global business process information; 5) global supply chain information; and 6) secure information. The first three information requirements are important for supporting management decisions while the other three are important for supporting global businesses' operating decisions.

Enterprise Resource Planning (ERP) systems have been increasingly adopted to meet global business information requirements. ERP systems capabilities that support global business information management include multi-level and multi-purpose information management; delivering accurate, timely and consolidated information; integrating global business process information; managing global supply chain information and transmitting secure information.

Using structural equation modelling (SEM) technique, this research established that if two variables (global business information requirements and ERP systems capabilities) co-align, this resulted in improved business performance. The co-alignment in this research is adopted from Venkatraman's explanation of "fit as co-variation/co-alignment" perspective. This perspective argues that the match or internal consistency among a set of theoretically related dimensions such as resources and strategies, business and information technology (IT), business and IT structures, strategic and IT competencies, will deliver improved business performance.

SEM is a multivariate technique that combines aspects of factor analysis and multiple regression enabling researchers to simultaneously examine a series of interrelated dependent relationships among the measured variables and latent constructs as well as between several latent constructs. In this research the SEM technique has been used because it supports the establishment of multiple relationships between dependent and independent variables in the proposed model.

Performance outcomes of global business as a result of co-aligning ERP systems capabilities and global business information requirements are measured using four perspectives: financial performance; customer performance; learning and growth performance; and internal business process performance. Therefore, the global business performance in this research is based on a balanced scorecard performance measurement framework. This research was a positivist study encompassing an online survey of 196 managers from global organisations that are using ERP systems to support their business operations.

Findings of this research supported the conceptualisation of fit from the co-alignment/co-variation perspective, confirming that the co-alignment of global business information requirements and ERP systems capabilities leads to better business performance of global organizations. The findings also confirmed that global organisations have unique information requirements that are somewhat different to local businesses. ERP systems are able to support global business information requirements. Findings also confirmed that the financial, customer, learning and growth and internal business process performance of global organizations are moderated by the organization size and the number of years the organization has been operating globally.

Not only does this research fill the void in global business literature by investigating the important role information plays in global business management, but it extends the ERP literature and IT/IS alignment theories to the co-alignment of IS capabilities with global business information requirements for improved performance outcomes.

The major contribution to knowledge this research makes is the development and validation of a co-alignment model, extending theories of IT/IS alignment to the alignment of a specific information system (ERP system) to a specific type of business (global business). The model developed as an outcome of this research is a guide for aligning specific types of information systems (ERP systems) to specific organisational requirements (global business information requirements) for improved performance.

CHAPTER 1. INTRODUCTION

1.1 Introduction

This study explores the impact of aligning enterprise resource planning (ERP) systems capabilities and global business information requirements on global business performance. It seeks to develop and validate a research model, extending IT/IS alignment theories to the alignment of a specific information system (ERP system) to a specific type of organisation (global business) for improved performance.

This chapter includes a brief research background and motivation for the study, the research gap, research objective, research questions, significance and research contribution followed by an outline of the thesis structure.

1.2 Research background and motivation

Global business has become an important business trend in the last decade, dominating the world's trade and investments (Gunter and Andrea, 2009; Li Da, 2011). Every day over USD 15 trillion worth of goods and USD 3.7 trillion worth of services are exchanged across national borders (Hill, 2011). Furthermore, the world's largest global organisations are now contributing to half of the global trade and 90% of the world's foreign direct investments (Sarker et al., 2010). As a result, the number of organisations that operate on a global scale is rising. There are many reasons, including competitive advantage (Pangarkar and Yuan, 2009), profitable business opportunities (Aberdeen, 2007), increased demand for goods and services (Harrison, 2010), decline in cross-border trade barriers (Hill, 2011), formation of global and multi-national strategic alliances (Koren,

2010) and rapid development in information and communications technologies (Hill, 2011) have contributed for this unprecedented growth in global businesses.

Managing global business operations is complex, expensive and challenging (Carter, 2010), and somewhat different from managing a traditional business, due to the complexities created by national, cultural, organisational and technical differences in different countries (Sannarnes, 2010). The extant literature acknowledges that global organisations have unique information requirements somewhat different to that of local businesses (Ghosh, 2002). This is due to integrated business activities from geographically dispersed business units (Buckley and Casson, 2009), the need for sourcing up-to-date consolidated information from geographically dispersed business processes (PricewaterhouseCoopers, 2010), operating in different time zones (Yap, 2005) and managing global supply chains (Koren, 2010).

Global organisations are increasingly adopting ERP systems to meet their information requirements and support their global operations (D'Aquila et al., 2009; Koumpis and Protogeros, 2010). These systems are being adopted to integrate business processes and information for business decisions (McGaughey and Gunasekaran, 2009). In an international context, ERP systems play an important role in integrating information from business units across national boundaries (Madapusi and D'Souza, 2005; Gagnon and Pinsonneault, 2009) and harmonising business processes across multiple sites and countries (Gunter and Andrea, 2009).

Although ERP systems are widely adopted to support global business operations, how well ERP systems capabilities are aligned with global business information requirements to deliver timely information is not known. Even though a considerable number of academic studies on ERP systems (Aloini et al., 2007; Esteves and Bohorquez, 2007; Moon, 2007) and IT/IS alignment (Chan and Reich, 2007; McLaren et al., 2011) have been undertaken, to date alignment of ERP systems to global business information requirements for improved performance remains a gap in the extant literature. This research fills this void by establishing the alignment of ERP systems to global business information requirements for improved global business performance.

1.3 Research gap

Since global business is a growing business trend, and as suggested above, ERP systems support global business operations, it is imperative to explore the suitability of ERP systems capabilities for managing global business information requirements and its impact on business performance. Although many academic studies on ERP systems (Aloini et al., 2007; Esteves and Bohorquez, 2007; Moon, 2007) and the alignment of IT/IS to business (Chan and Reich, 2007; McLaren et al., 2011) have been done, to date research on the outcome of ERP systems capabilities alignment to global business is sparse. Therefore, investigation of how ERP systems capabilities can be aligned to global business information requirements and what impact it would have on global business performance become imperative. This research addresses this research gap by investigating the alignment of ERP systems capabilities to global business information requirements for improved performance.

1.4 Objective of the research

The main objective of this research is:

To determine the alignment of ERP systems capabilities to global business information requirements for improved global business performance.

1.5 Research questions

To address the above research objectives, this research seeks to answer the following research questions.

The primary research question is:

1) Should ERP systems capabilities be aligned to global business information requirements for improved global business performance?

The sub research questions are:

1) What are the information requirements of global organisations?

2) Which ERP systems capabilities are useful for managing global business information requirements?

3) To what extent can these ERP systems capabilities support global business information requirements?

1.6 Significance

This research addresses an important emerging issue in global business, ERP systems and global business performance literature. ERP systems have been increasingly adopted by global businesses to manage their business operations. However, research focuses on ERP systems capabilities meeting global business information requirements is a gap in the extant ERP systems and global business literature. This research establishes global business information requirements, ERP systems capabilities suitable for managing these information requirements, and the impact of aligning these two constructs for improved global business performance.

To establish the suitability of ERP systems capabilities in supporting global business information requirements, this study reviews existing literature on ERP systems, global business and business performance. A review of IT/IS alignment studies (Appendix- A) has also been undertaken to determine the most suitable alignment framework to achieve improved performance by aligning these two constructs, global business information requirements and ERP systems capabilities.

The literature review reveals that the global businesses have unique information requirements that differ from those of local businesses. This review also indicates that the ERP systems have capabilities suitable for managing global business information requirements. Based on Venkatraman's (1989) co-alignment/co-variation perspective of fit, it then maps the ERP systems capabilities to global business information requirements to establish global business performance improvements. The research establishes that if ERP systems capabilities are co-aligned with global business information requirements, improved outcomes in the areas of financial, customer, learning and growth and internal business process performance will be achieved.

Research findings identified a unique set of global business information requirements, ERP systems capabilities meeting these requirements, and the performance outcomes of global business using Venkatraman's (1989) co-alignment/co-variation perspective of fit between global business information requirements and ERP systems capabilities. This was accomplished using the structural equation modelling (SEM) technique.

1.7 Research contribution

This research makes a useful contribution to the field of information systems and global business. It has several theoretical and managerial contributions (Chapter 7). This research addresses a niche in ERP systems research by applying its capabilities to global business. It identified a set of information requirements essential for global business management. This study extends Venkatraman's (1989) conceptualisation of fit as co-alignment/co- variation to the alignment of ERP systems capabilities and global business information requirements for improved global business performance.

Furthermore, this study makes a useful contribution to the business performance literature by extending the balanced scorecard measures of business performance based on alignment of ERP systems (IT) and information requirements of global businesses and, adding to business performance literature the outcomes of aligning ERP systems capabilities to global business information requirements. Findings imply that the alignment of global business information requirements and ERP systems capabilities improve business performance of global organisations.

1.8 Thesis outline

This thesis is structured into seven chapters as follows.

Chapter 1: Introduction

This chapter discusses research background and motivation, research gap, research objective, questions and contributions.

Chapter 2: Review of the literature

Chapter Two reviews the relevant literature on global business, ERP systems and IT/IS alignment and business performance. It begins with a discussion of studies on global business and global business information requirements. The second section reviews ERP systems and ERP systems capabilities, which are then mapped to global business information requirements to derive a number of hypotheses leading to improved business performance. The third section looks at studies on IT/IS alignment by analysing existing IT/IS alignment models. The fourth section discusses analyses of business performance outcomes. A number of hypotheses derived from the literature review and proposed research model are presented at the end of this chapter.

Chapter 3: Research methodology

Chapter Three discusses the research methodology adopted and it begins with an outline of the research paradigm. It then describes the research process, research design, research plan, research methodology, research strategy, instrument development, pilot study, sampling strategy, ethical considerations, online survey, response rate, and sample profile. This chapter concludes with a discussion of data analysis techniques and a summary of the main themes covered.

Chapter 4: Data cleaning and demographic statistics

This chapter presents data cleaning and demographic statistics gathered in this research. It begins with a discussion of missing data, outliers, normality, central tendency (mean, median and mode), reliability of the data, non-response bias and common method bias. It then examines the demographic statistics of the responding organisations including responses according to region, industry composition, geographical distribution, organisation size, globalisation history, other systems for managing global operations and managerial positions held by respondents.

Chapter 5: Measurement model validation

Chapter Five discusses the measurement model of the proposed research. This research uses structural equation modelling (SEM) technique to validate measurement model. It establishes the information requirements of global businesses, determines the extent to which ERP systems can meet global business information requirements and examines the impact of co-aligning global business information needs and ERP systems capabilities on global business performance. First, an exploratory factor analysis (EFA) was conducted. Then, one-factor congeneric measurement models of all the variables were developed and validated. Next, measurement models of the three main constructs, global business information requirements (GBIR), ERP systems capabilities (ERPSC) and global business performance (GBPER) are developed and validated. The chapter concludes with a discussion of full confirmatory factor analysis (CFA) measurement model and the summary.

Chapter 6: Structural model validation and hypotheses testing

Chapter Six discusses the results of structural model validation and hypotheses testing. It begins with a discussion of the co-alignment and direct effect models. Then it compares the results of the co-alignment model and the direct effect model. Next, reliability, discriminant validity and convergent validity of the co-alignment model are established. The chapter concludes with a discussion of moderator variables and hypotheses validation.

Chapter 7: Discussion, conclusion and future research

This chapter discusses the key findings, conclusion and implications of this study. The chapter starts with a discussion of global business, global business information requirements and ERP systems capabilities. Then it looks at the proposed structural models (co-alignment model and direct effect model), hypotheses validation and the impact of moderator variables and global business performance, followed by answering the research questions. This chapter relates the findings to existing theory, highlights future research issues and contribution to knowledge.

CHAPTER 2. REVIEW OF THE LITERATURE

2.1 Introduction

To understand if ERP systems capabilities adequately meet global business information requirements for improved performance, the relevant studies on these topics are evaluated in this chapter. The literature review is sourced from scholarly journals, dissertations, online articles, books and reports. The key words or terms used for relevant literature search were “ERP systems”, “ERP systems capabilities”, “global business”, “global business information requirements” and “business performance”. To understand the fit between ERP systems capabilities and global business information requirements, an evaluation of extant IT/IS alignment models was also undertaken (Appendix - A).

The chapter is divided into five sections. It begins with a discussion of global business and global business information requirements. The second section reviews ERP systems and ERP systems capabilities. The third section looks at business performance. To explain the match between the two main constructs (business requirements and IT capabilities) for improved business performance, a review of studies on existing IT/IS alignment models is also included. The fourth section discusses analyses of business performance outcomes. A number of hypotheses derived from the literature review and proposed research model are presented at the end of this chapter.

2.2 Literature review on global business

This section reviews and discusses relevant literature on global business. It identifies types of global businesses, discusses reasons for global business growth, discusses global business management issues, discusses challenges of global business management, and finally identifies information requirements for global business operations.

2.2.1 Global business

Different authors in the academic literature have defined global business differently. There are four distinct types of global organisations generally referred to as global, international, multinational and transnational organisations.

Global organisations typically consist of a network of interconnected departments, sections or units competing at a global level (Kumar et al., 2008) with multinational operations transferring finished goods, services, skills and resources across national boundaries (Hill, 2009b). They operate simultaneously in multiple countries to achieve a competitive advantage (Spulber and Daniel, 2007) and to pursue both national and global opportunities (Parhizgar, 2008). Global organisations follow the business model of pursuing low-cost opportunities worldwide, although the consumer trend is a few business activities concentrated in a few favourable locations (Hill and Jones, 2004). This model enables exploitation of opportunities by sourcing competencies, knowledge, expertise and products from foreign markets (Bartlett and Ghoshal, 1998). Under this structure, the parent company maintains centralised control over core competencies and decentralises some operating and decision-making functions to individual subsidiaries (Hill, 2011). Some of these activities may be shared (Chhai and Lan, 2005).

International organisations exploit opportunities in the global arena by transferring core competencies, knowledge, expertise and products to foreign markets where indigenous competitors lack those skills (Bartlett and Ghoshal, 1998; Hill and Jones, 2004; Hill, 2011). In international business, a parent company partly delegates controlling and decision-making power to individual or subsidiary business units (Kelzenberg et al., 2008). Although the subsidiaries of international businesses are considered to be an integral part of the group (Chhai and Lan, 2005), a parent company retains a high degree of influence and control over their operations (Bartlett and Ghoshal, 1998).

Multinational organisations on the other hand are described as firms that own and control business activities in two or more countries (Buckley and Casson, 2009) primarily to compete in international markets (Fraser and Oppenheim, 1997). According to Bartlett and Ghoshal (1998), multinational companies generally manage a number of national entities operating in different national environments. Products and services offered by them are differentiated to satisfy local customers' needs (Madapusi and D'Souza, 2005). Although the subsidiaries of multinationals enjoy a high level of independence regarding their operational activities (Reimers, 1997), headquarters maintains a high level of control and coordination over the financial and reporting aspects (Chhai and Lan, 2005) of all business operations.

Transnational businesses are referred to as organisations consisting of a network of businesses (Kelzenberg et al., 2008) and focused on achieving both local responsiveness and global efficiency (Madapusi and D'Souza, 2005). Such organisations maintain a balance between local responsiveness and global integration (Clemmons and Simon, 2001) by adopting both centralised and decentralised approaches for decision-making (Hill, 2011). They adapt to all environmental contexts by maintaining a high level of coordination between geographically dispersed business units to achieve success (Clemmons and Simon, 2001).

The usual strategy for commencing global business activities is to first establish a few subsidiaries in the home region (Hutzschenreuter et al., 2010) and then gradually expand their scope to outside regions (Hutzschenreuter et al., 2010). Furthermore, these organisations follow a development path of being “international” to “multinational” to “global” to “transnational”, in the process of becoming truly global (Bartlett and Ghoshal, 1998; Peppard et al., 1999). Businesses of all sizes, varying from a small sales office to a large-scale integrated network, can now perform business activities on a global scale to exploit opportunities in the global arena (Peppard et al., 1999). According to Buckley and Casson (2009), globalisation of business is a general strategy or a principle that explains the boundaries of today’s enterprises. Hill (2011) has stated that international, multinational, global and transnational organisations are based on the type of strategy used to position the firm in the global market. Selecting a suitable strategy to compete globally is an internal organisational decision (Hill, 2011) that varies according to the pressures for cost reduction and local responsiveness (Hill and Jones, 2004).

The above literature discussion indicates that all of these businesses possess similar attributes such as operating in a number of countries; leveraging both domestic and international opportunities; dealing with multiple languages, currencies, taxation and reporting requirements; and dealing with customers, suppliers, investors and government agencies in various countries. Differences and similar attributes of multinational, international, global and transnational companies are presented in table 2.1.

Table 2-1: Differences and similarities of four types of global businesses.

Differences				Similarities
Global organisations	**International organisations**	**Multi-national**	**Transnational**	
Competing globally	Exploit opportunities in the global arena	Primarily compete in international markets	consisting of a network of businesses	Operate in many countries
Consist of network of interconnected business units	Core competencies are generally centralised	Own and control business activities in two or more countries	focused on achieving both local responsiveness and global efficiency	Leverage domestic and international opportunities
Operate simultaneously in multiple countries	Parent company retains a high degree of control and influence	Products and services offered are differentiated to satisfy local customers' needs	organisations maintain a balance between local responsiveness and global integration	Deal with multiple languages, currencies, taxation and reporting requirements
Pursue both national and global opportunities	Parent company partly delegates controlling and decision-making power	Decentralised and national self sufficient	adopting both centralised and decentralised approaches for decision-making	Deal with customers, suppliers, investors and government agencies in various countries
Parent company maintains centralised control over core competencies	Knowledge developed at the head office and transferred to overseas units	Subsidiaries enjoy a high level of independence	maintaining a high level of coordination between geographically dispersed business units to achieve success	
Decentralised some non core operations and decision-making		Headquarters maintains a high level of control over the financial aspects		
Knowledge developed and retained at the head office		Knowledge developed and retained within each business unit		

Since multinational, international, global and transnational companies have similar attributes and business objectives, for the purpose of this thesis they are all referred to as global organisations. The next section discusses reasons for global business growth.

2.2.2 Reasons for global business growth

Many reasons have contributed to the unprecedented growth of global businesses. These are presented in the following section.

2.2.2.1 Competitive advantage

An important reason for global organisations setting up business activities in numerous countries is competitive advantage that can be gained from producing goods and services in different countries (Pangarkar and Yuan, 2009). Competitive advantage according to Porter (2001) is achieved from low labour costs, low cost of raw materials, skilled personnel, better technologies and superior methods of production. The cost and quality of factors of production vary in different countries (Hill, 2011). Some countries possess more resources and skills such as low-cost labour, low-cost capital and unique resources (Spulber and Daniel, 2007), and therefore become specialised in producing certain products or certain services. For instance, in the automobile industry, Mexico specialises in making tyres, China specialises in making camshafts and the USA specialises in overall automobile design (Friedman, 2006). In the aircraft manufacturing industry Japan specialises in making parts for fuselage, doors and wings, Singapore specialises in manufacturing doors for the nose landing gear and Italy specialises in making wing flaps (Hill, 2011).

The above discussion indicates that competitive advantage achieved from global opportunities is an important reason for extending operations to global locations.

2.2.2.2 Profitable business opportunities

Profitable business opportunities according to Koren (2010) include increase in profits, cost reduction, secure enterprise growth, stable market share and customer base, productivity improvement and quality improvement. Previous studies have indicated that there is a positive relationship between global expansion and organisational profitability (Arild et al., 2007). A study done by the Aberdeen Group revealed that the growth in profitable business opportunities is one of the key reasons for businesses consider going global (Aberdeen, 2007). In their study, the majority of companies (79%) considered the global market as a growth opportunity that reduces operational costs (Aberdeen, 2007). Thus, the pursuit of profitable business opportunities worldwide is an important reason for global business growth.

2.2.2.3 Increased demand for products and services

Developments in information and communication technologies have led to e-commerce and m-commerce resulting in an increased demand for products and services worldwide (Mann, 2007; Turban et al., 2010). This has created the need to expand the capacity of existing businesses to achieve sales with a global reach. For example, Dell, an information technology company, recently expanded its manufacturing and distribution capabilities across the United States and into Asia, Europe, and South America to keep pace with worldwide demand of their products (Swartz et al., 2007).

2.2.2.4 Deregulation of economic policies and trade barriers

Deregulation of economic policies and trade barriers enable organisations to trade with less restriction in the global arena. The collapse of Communism in the early 1990s and rise of deregulated trade policies (Ramamurti and Singh, 2009), as well as the opening up of Indian and Chinese economies for global trade (Koren, 2010), has led to an unprecedented growth in global trade in the last two decades. Furthermore, the formation of numerous free trade agreements such as North American Free Trade Agreement (NAFTA), South Asia Free Trade Agreement (SAFTA), Asian Free Trade Area (AFTA) and European Union (EU) Free Trade Agreement (Koren, 2010) and multi-national strategic alliances such as General Motors Corporation (GM), United Technologies Corporation (UTC), have also opened up national economies and organisations to global trade (Cho et al., 2009; Tellis et al., 2009).

The World Trade Organisation (WTO), International Monetary Fund (IMF), World Bank and United Nations (UN) also play an important role in supporting global business (Ramamurti and Singh, 2009). These organisations play a key role in global trade negotiation and liberalization, revival in world trade and investment, policy development in global trade and investment, ensuring the stability of the international monetary and financial system, offering fiscal and financial stimulus packages to promote global trade and investment and initiating multilateral trade rules and dispute settlement mechanism to protect global trade, (Gurría et al., 2010). These roles promote global trade and investment, facilitating global businesses to trade with other organisations in many different countries.

2.2.2.5 Developments in information and communication technologies (ICT)

Modern economies around the world are highly dependent on ICT for economic development (Koumpis and Protogeros, 2010). The influence of ICT is evident in business activities such as production, marketing, accounting, human resource management and research and development (Roy and Sivakumar, 2007). Developments in ICT have become critical for global business in the last two decades (Hill, 2011) by supporting integrated information management, coordination and planning (Peppard, 1999). It has helped decrease telecommunication costs, eliminate distance barriers, deliver economies of scale and made global trade more affordable (Kenney et al., 2009).

The Internet and the World Wide Web are important technological developments supporting global trade (Shimizu et al., 2006). These technologies have developed a bigger market for global trade by helping reach billions of consumers worldwide (Koumpis and Protogeros, 2010). E-commerce is being adopted at an increasing rate enhancing business opportunities in the global arena (Ramamurti and Singh, 2009). The Internet and e-commerce have resulted in new business models that support purchase and exchange of goods online all around the world (Bhansali, 2010).

Information systems such as ERP systems that can integrate business functions from any part of the world have also supported global business growth (Gunter and Andrea, 2009). ERP systems support multi-business functions (Sane, 2005), recognise legal and tax reporting needs of various nations (Subramoniam et al., 2009), handle multiple enterprises (Siau, 2004), multi-languages and multi-currencies (Subramoniam et al., 2009). They also operate on a web-enabled architecture (Siau, 2004), provide real time data access (Subramoniam et al., 2009), enforce data integrity (Subramoniam et al., 2009) and foster speedy intra and extra organisational communication (Subramoniam et al., 2009). These capabilities are extremely important for managing business operations in the global arena (Koumpis and Protogeros, 2010). Therefore, these systems are increasingly adopted by organisations around the world to support global operations (Koumpis and Protogeros, 2010).

2.2.2.6 Outsourcing business processes

To take advantage of lower production and service costs, as well as specialised skills, outsourcing of business processes to low-cost offshore partners such as China, India, Singapore, Malaysia and Brazil (Bharadwaj et al., 2010) has increased. Business process outsourcing (BPO) delivers benefits of cost savings, greater flexibility, access to specialised process expertise, quality improvement, realised core competencies, strategic advantages, and better coordination for business organisations (Lacity et al., 2009).

Improved business performance and organisational profitability are achieved by outsourcing non-core business activities and specialised processes (Bharadwaj et al., 2010) enabling organisations to concentrate on their core business activities (Shuangqin and Bo, 2010). Hence, many global companies have outsourced manufacturing related processes to low-wage countries such as China and Malaysia and IT related functions to India (Harrison, 2010). IT development, IT maintenance, IT operations, data centres, help desk, PC and IT infrastructure maintenance have been outsourced to India, Canada and the Philippines by many US and European companies (Palvia, 2007).

Other outsourced business processes include insurance (Harrison, 2010), accounting (Mathews, 2009), taxation (Hill, 2011), film and cartoon production (Palvia, 2007) and healthcare (Hill, 2011). Continuous decline in trade barriers and developments in ICT make outsourcing more affordable and financially viable (Chadee and Raman, 2009). Thus, BPO is increasingly becoming an important contributor to global business growth (Bharadwaj et al., 2010).

2.2.2.7 Other reasons

Other reasons include access to unique resources in foreign countries (Peppard, 1999; Hutzschenreuter et al., 2010), low cost labour in China and low cost IT professionals in India, economies of scale (Peppard, 1999; Hutzschenreuter et al., 2010), international reputation and supportive government policies and financial incentives (Harrison, 2010). These factors have influenced organisations to seek opportunities globally. In addition, growth in specialised services such as investment banking, private equity, venture capital industries, financial and accounting, law, management consultancy (Ramamurti and Singh, 2009), marketing, quality assurance (Monplaisir et al., 2009), information technology, call centres, engineering, procurement and research and development (Kenney et al., 2009) have contributed to the increase in global businesses.

The above discussion indicates that competitive advantage, profitable business opportunities, increased worldwide demand for products and services, deregulation of economic policies and trade barriers, free trade agreements, strategic alliances, development in ICT, expanding Internet use and e-commerce, and growth in business process outsourcing to low cost countries are important reasons for global business growth. Large information systems such as ERP systems play an important role in managing global business functions and related information for quick decisions.

2.2.3 Global business management

Management of global business is more complex than the management of a single site or a domestic business (Ho et al., 1998; Peppard, 1999). These organizations generally operate in more than one country and some large global organizations have business operations in many countries in the world. For example, HP, the world's largest technology company is currently operating in over 170 countries (Friedman, 2006); Cisco, the worldwide leader in networking for the Internet, operates in over 165 countries (Cisco, 2011); Dell, the global information technology company, does business in over 180 countries (Dell.com, 2011); and Coca Cola, the world's largest beverage company, is operating in over 200 countries (Coca_Cola, 2011). Since the geographically distributed business activities of global businesses are interdependent, it is necessary to manage them on an integrated basis to provide a holistic view of the organisation (Buckley and Casson, 2009). It helps global businesses to have a stake in the global market, strengthen core competencies, increase competitive advantage, become the champion in the industry, and to develop sustainably (Shuangqin and Bo, 2010). Maintaining a strong partnership between global subsidiaries, suppliers, contractors, customers, capital markets, government organisations and other business partners is critical in managing global business activities.

2.2.3.1 Effective global partnership management

Global organisations not only rely on internal business partners such as other business departments, employees and shareholders but also with external business partners such as suppliers, contractors, competitors and government agencies in delivering efficient products/services to their customers (Arnold et al., 2010). Many of the business activities of global businesses are managed through offshore partners (in-house and outside) (Dholakia and Firat, 2006; Palmisano, 2006). For example, Nike, the world's largest seller of athletic footwear and apparel, uses over 600 contract manufacturers from 46 countries for its products (NIke.com, 2011b). In addition, global organisations form many kinds of inward-outward relationships such as joint ventures, alliances, teams, partnerships and associations in order to manage business activities on a global basis (Sun, 2009).

Successful global companies mainly focus their attention on core competencies and manage most of the non-core activities through outside business partners, who can do these activities effectively and efficiently (Koren, 2010). Some global businesses that are in the same industry may use the same manufacturers to make their products. For instance, companies such as Nike, Adidas and Reebok sometimes use the same contract manufacturers (Lichtenstein, 2007; Peppard, 1999). Therefore, maintaining effective and integrated relationships with all these business partners is essential for global business management.

2.2.3.2 Supply chain relationship management

In global business, products and services are not entirely produced in one place or in a single process (Dholakia and Firat, 2006). It is a multifunctional effort requiring a high level of collaboration and coordination of all the parties involved in the supply chain

(Monplaisir et al., 2009). Thus, maintaining an integrated relationship with all supply chain partners is extremely important in managing business activities (Arnold et al., 2010). It facilitates the coordination of business activities (Arnold et al., 2010) and enhances business performance (Sheng, 2010). Information technology plays a major role in managing supply chain relationships in global businesses. For instance, Dell has a strong supply chain management system that integrates all the supply chain partners to facilitate smooth functioning of its business operations. Dell accepts customer orders through the Internet and telephone inquiries, and product parts are manufactured in China and Taiwan, and then shipped to assembly plants in Austin (Texas), Nashville, Winston (North California), Miami, Mexico, Limerick (Ireland), Lebanon, Malaysia, Chennai or any other production plant close to their customers (Koren, 2010). Furthermore, they need to deliver these products within 4-5 business days (Koren, 2010). Their supply chain model is highly dependent on IT and facilitates better coordination and integration of business activities.

The above discussion demonstrates that the production process of global business is highly complex. Products' parts come from suppliers in many different countries. It is also clear that the global operations are heavily reliant on numerous business partners for timely delivery of products and services. In order to achieve business success, all these business processes and supply chain members need to be seamlessly connected; exchanging up-to-date information related to production planning, material management, inventory levels and delivery dates. Information plays a major role in maintaining a supply chain relationship.

Global businesses must therefore have an efficient information system that facilitates the supply chain relationship management (Friedman, 2006). It improves competitive advantage, minimises delays, overproduction and cost overruns (Friedman, 2006). For instance, on an average day, Dell sells about 140,000 to 150,000 computers. Once these orders are accepted the suppliers receive a signal stating every component in the machine customer ordered, so suppliers know what they have to supply. Every minute a supplier can see the type of components and quantities to be delivered. Every two hours Dell's factories send an email to their suppliers, stating what parts and what quantities must be delivered within the next ninety minutes. It facilitates Dell factories to receive all the parts needed for all computers ordered in the last two hours (Friedman, 2006). Citing other example, Procter and Gamble, global manufacturer of consumer goods, established an integrated information system that allows Procter and Gamble to monitor selling and inventory of its products in all Wall-Mart's branches. Based on this Procter and Gamble can adjust its production and sales plans (Shuangqin and Bo, 2010). As another example, the Society for Worldwide Interbank Financial Telecommunication (SWIFT) helps over 8,000 financial institutions worldwide to handle messages related to monitory transactions such as payments, securities trades, and treasury purchases. SWIFT handles over 15 million massages a day with the help of its global information system (Bidgoli, 2010). These cases demonstrate the important role information systems play in managing supply chains of global businesses.

It is clear from the above discussion that managing a global business is complex and challenging. It involves a number of internal, external business partners and suppliers. These business partners and suppliers operate in many different countries and in order to achieve business success they need to maintain strong coordination between these business partners and suppliers. Information systems play a major role in maintaining this relationship and achieving business objectives effectively and efficiently. The challenges of global business management are discussed in the next section.

2.2.4 Challenges associated with global business management

Management of global business operations requires coordination, collaboration and integration across multi-site operating units' worldwide (Peppard, 1999; Koren, 2010). Managing business activities in different global locations is complex, expensive and challenging (Carter, 2010). It is different to managing a traditional local business due to the complexities of national, cultural, organisational and technical differences (Sannarnes, 2010). These challenges can result in increased costs if poorly managed (Pangarkar and Yuan, 2009). Thus, establishing competent global information management practices incorporating geographically dispersed business units is critical to improve business performance (Kettinger et al., 2010). However, establishing such a relationship incorporating all the business units is much more challenging. Global businesses encounter many problems when managing activities on an integrated basis involving geographically dispersed business units (Buckley and Casson, 2009). These challenges are usually not common in a single country environment (Shi et al., 2010). Challenges global businesses encounter due to being geographically dispersed are discussed below.

2.2.4.1 Timely information

Timely information plays an important role in making effective business decisions and operational management (PricewaterhouseCoopers, 2010). Decisions need to be made on an on-going basis in the current competitive business environment (Koren, 2010) for which timely information is critical. It can be achieved only by exchanging up-to-date information across the global supply chain members (Koren, 2010). Most global businesses face the challenge of extracting accurate information on a regular basis as the environment in which they operate is complex and involves many different parties (Sannarnes, 2010). Without timely information operational inefficiencies and numerous other delays are encountered (SAP_AG, 2004) affecting the much needed quick responses to changing market and customer demands, global trends, stocks and share trading (Koren, 2010). Without timely information, global businesses can face numerous problems. Example, SAP_AG, (2004) reported how BHP Billiton could not obtain consolidated spending on a particular supplier due to log-in into multiple systems, requesting the same information several times and then collating the results. It was a cumbersome process that resulted in several reports.

2.2.4.2 Technological challenges

Technology plays an important role in providing timely information required for global business management. Effectively applying technologies to integrate all global operations is a challenge (Koren, 2010). Although all global businesses are applying technologies in one way or another, many are unable to take full advantage of technologies to improve their business outlook (Koren, 2010) due to legacy systems, a lack of technology skills and culture as well as the complex nature of these organisations (SAP_AG, 2007).

There are many issues related to coordination of business processes in global businesses due to the complex nature of these organisations (SAP_AG, 2007). These may include issues associated with processing of financial transactions such as handling cash deposits, receipts and payments, recording transactions, handling and recording inventories and other assets, planning and recording of material requirements, production and human resource management, procurement, supplier relationship management and customer relationship management (Kumar et al., 2008). Technology can play a major role in overcoming these challenges. Example, Dell Computers has a system where a customer places an order it is assigned a dedicated bar code that accompanies the order until it is delivered to the customer. Dell has an integrated web-based information infrastructure, which can be used to connect most of its business processes. It uses a laser readable bar code to instruct production line workers what to do in the production process. Finally, the bar code, which includes the customer's address, is attached to a box and is delivered to the customer. Dell can also trace the production history and customer experience from a single database (Koren, 2010).

Resources and technology capabilities are limited in some global units, thus, effective management of the available resources and technology capabilities are important to achieve business success (Sun, 2009). Having different systems for managing different processes such as production, information technology, accounting and finance, planning and budgeting, human resources and marketing can hinder business success (Bidgoli, 2010). Therefore, standardization of systems, data and business processes are central to attaining high quality integrated information in global businesses (Ghosh, 2002). However, many organisations struggle to achieve this even in one country, so it is much more challenging in a global business context (Hawking, 2008).

2.2.4.3 Working in different time zones

Time differences exist between business units and office hours overlap between subsidiaries operating in different parts of the world, thus creating communication, coordination and collaboration difficulties (Yap, 2005), unless they are effectively managed. Although developments in ICTs and some newly developed business principles such as ‘follow the sun’ (Carmel et al., 2010) can manage global teams, business units operating in different time zones do face important issues (Chudoba et al., 2005). For example, working as a single team around the clock, sharing the views and experiences of team members is extremely important in managing business activities (Yap, 2005). However, coordinating and integrating activities integrating all these business located in many different time zones is a major problem (Akmanligil and Palvia, 2004). For example, if the head office in the USA wants some urgent information at 11 am from the management team (factory) in China, it would not be possible to get that information quickly from the Chinese team, considering it would be 3 am there (Gandhi, 2009).

Coordinating and controlling information related decisions for all business units in many different time zones are more challenging (Peppard et al., 1999; Sankar and Rau, 2006). Furthermore, operating in different time zones requires global organisations having to allocate more resources for some business activities such as system maintenance, security, preventative measures and file maintenance (Ives and Jarvenpaa, 1991). Time zone differences can sometimes cause difficulties for employees such as stress in personal life and problems in maintaining the work/life balance. For example, some employees may work during normal working hours and they will work from home to provide some information to other global business units (Gandhi, 2009).

2.2.4.4 Global supply chain management

Maintaining an integrated relationship with all supply chain partners is extremely important in managing business activities of global businesses (Arnold et al., 2010). It facilitates the coordination of business activities (Arnold et al., 2010) and enhances business performance (Sheng, 2010). Global businesses require coordination of a large number of supply chain partners (Koren, 2010) who are located many different countries. In today's business world, organisations cannot survive as entities bounded by few supply chain partners (Friedman, 2006). They need to maintain a strong relationship with many different supply chain members such as suppliers, customers, contractors, manufacturers, distributors, wholesalers, retailers and government organisations (Koren, 2010; Wang et al., 2011). The competitiveness of modern businesses depends on the ability of maintaining a strong relationship with suppliers, customers and other business partners (Schubert and Legner, 2011; Arnold et al., 2010; Hill, 2009a, Turban et al., 2010). Ineffective supply chain relationship management will lead to problems such as increased inventory costs, poor quality, production delays and customer complaints (Wang et al., 2011).

Global organisations increasingly rely on their supply chain partners for complementary business activities (Schubert and Legner, 2011). These supply chain partners are situated in many different countries. Thus, maintaining an on-going relationship with all these supply chain partners is challenging due to the involvement of several business partners, often in many different countries and time zones (Hill, 2009a; Turban et al., 2010). Furthermore, global organisations usually adopt the strategy of merging with or acquiring another overseas organisation, or forming an alliance or partnership with such an institution (Schnee, 2010).

Intense global competition, dynamic business complexity and increased customer sophistication demand global organisations to maintain a strong integrated relationship with their worldwide supply chain partners (Kien and Lian, 2009). Information is the link that enables global businesses to communicate and collaborate with their globally dispersed supply chain partners (Turban et al., 2010). However, in practice forming such a relationship using existing systems or mechanisms is challenging, as some of these systems may not be compatible (Schnee, 2010). How information system capabilities can be used to maintain this relationship is an obstacle that has to be overcome (Julian et al., 2001). Time differences, communication barriers, coordination and cultural differences among business units challenge global organisations in achieving their business objectives (Sarker et al., 2010).

2.2.4.5 Cultural differences

Global businesses generally operate in many different cultural settings (Corbitt, 2003), including work ethics (Kosaka, 2004), religious beliefs (Chadee and Raman, 2009), corporate governance practices (BPP_Learning_Media, 2009b), and thinking and working methods and reporting styles (Shuangqin and Bo, 2010). Dealing with different cultures challenges global businesses in achieving their organisational objectives (Peppard, 1999; Bidgoli, 2010). Culture influences business operations including strategic formulation, organisational design, human resource management, leadership, marketing, accounting, mergers and alliances and supply chain management (Wisma, 2008).

Large multinational companies also have to deal with employees speaking different languages (House et al., 2008) which sometimes results in communication barriers and impacts on organisational performance (Peppard, 1999; Yen and Sheu, 2004; Wisma, 2008). The cultural dissimilarities between business units of global businesses may lead to increased transaction costs related to training and acquiring information (Hahn et al., 2009). Understanding the cultural differences in different parts of the world is an an important global business challenge.

2.2.4.6 Other challenges

Other challenges faced by global businesses in managing business operations include coping with rapid technological (Serour, 2005), e-commerce and m-commerce developments (McGaughey and Gunasekaran, 2009); forming strategic alliances and partnerships (Arunatileka et al., 2009); gaining a competitive advantage (Parker, 2005); managing diversity (Parker, 2005); integration with government organisations, competitors and customers in multiple countries (Parker, 2005); dealing with multiple currencies, accounting standards, reporting guidelines, and compliance regulations (SAP_AG, 2009). Furthermore, global corporations have to address host countries' legislative demands, taxation requirements and environmental standards (Peppard, 1999; Ghosh, 2002). They must also be skilled in identifying consumer similarities and differences across national markets (Tellis et al., 2009).

To overcome these challenges global companies have invested heavily in integrated information systems such as ERP systems (Koumpis and Protogeros, 2010). ERP systems are able to integrate business processes nationally and globally (Gunter and Andrea, 2009), support multi-business functions (Sane, 2005), recognise legal and tax reporting needs of various nations (Subramoniam et al., 2009), handle multiple enterprises (Siau, 2004), multi-languages and multi-currencies (Subramoniam et al., 2009), and operate on a web enable architecture (Siau, 2004). Additionally, ERP systems provide real time data access (Subramoniam et al., 2009), manage resources productively and proactively (McGaughey and Gunasekaran, 2009), enforce data integrity (Subramoniam et al., 2009) and foster speedy intra and extra organisational communication (Subramoniam et al., 2009). These capabilities are extremely important for managing business operations of global businesses. Therefore, these systems are being increasingly adopted by global businesses to support global operations (Koumpis and Protogeros, 2010).

The above discussion illustrates that managing a global business is complex and challenging. The challenges faced by global businesses in managing their operations include integration of worldwide business activities, availability of up-to-date and consolidated information, coping with technological challenges, segregation of duties, working in different time zones, maintaining an integrated supply chain relationship, managing cultural differences and diversity, coping with e-commerce and m-commerce developments, forming strategic alliances and partnerships, integration with government organisations, competitors and customers in multiple countries and dealing with multiple currencies, accounting standards, reporting guidelines, and compliance regulations. To overcome these issues especially challenges relating to information management, global businesses are heavily relying on integrated information systems like ERP systems. These systems can support the requirements of global businesses. Global business information requirements are discussed in the next section.

2.2.5 Global business information requirements

Information plays an important role in achieving global business objectives, given that the current business environment is very competitive (Bidgoli, 2010). The ability to obtain up-to-date real time information is critical for assessing business opportunities and rationalizing business operations (Kettinger et al., 2010). Global businesses have unique information requirements (Ghosh, 2002) due to: firstly, integrated but geographically dispersed business units (Buckley and Casson, 2009); secondly, the need for sourcing up-to-date consolidated information from numerous business processes

(PricewaterhouseCoopers, 2010); thirdly, operating in different time zones (Yap, 2005); and fourthly, global supply chains (Koren, 2010). Information sourcing from global operations entails dealing with different cultures (Bidgoli, 2010), strategic alliances and partnerships with global stakeholders (Arunatileka et al., 2009), managing diversity (Parker, 2005) and dealing with multiple currencies, accounting standards, reporting guidelines, and compliance regulations (SAP_AG, 2009).

Availability of real time information that integrates core and supporting business processes across the enterprise is critical for business success (Kettinger et al., 2010). For this reason global organisations are increasingly depending on integrated information systems such as ERP systems to manage business activities (Ioannis and Joe, 2007; House et al., 2008; Koumpis and Protogeros, 2010). These systems can span geographic boundaries (Bidgoli, 2010) and possess the ability to support the information requirements of global businesses (Avison and Malaurent, 2007; Mishra, 2009). On this theme, determining the information requirements of global organisations is complex as it involves many different stakeholders with potentially conflicting needs and priorities (Kirsch and Haney, 2006). This has to be done at the early stage of a business project known as the 'requirements determination' phase (Kirsch and Haney, 2006). Managers' and other stakeholders' input, experience and knowledge of business processes have to be shared and integrated for successful completion of this phase (Kirsch and Haney, 2006). Indeed, information requirements of global organisations keep changing as they expand into the global arena (Kettinger et al., 2010). Information requirements for global operations are discussed in the next section.

2.2.5.1 Multi-level and multi-purpose information from global business units

Business activities of global organisations are generally spread in a number of countries in the world (Infosys_Technologis_Ltd, 2010). Information related to global companies' activities are generally processed and maintained by business units in various countries or in a centralised database (Chhai and Lan, 2005). For instance, production related data can be processed and maintained in a manufacturing plant in China, accounting related data in India, inventory data in another country and sales data somewhere else, etc. At the same time, managers of global organisations usually work in different countries (Bartlett and Ghoshal, 2003), and they need real time information to make effective business decisions (Chhai and Lan, 2005).

Integrated as well as disparate information covering all business activities of global business units are required for effective management of these organisations (Power and Sharda, 2009). Information requirements for managers at different levels in different business units are not always the same (Grant, 2003; Power and Sharda, 2009). For instance, directors who oversee the affairs of a whole business require higher levels of information such as a summary of the last five years' sales, a summary of profits and a summary of investments, whereas operational managers who oversee a production plant may require information on daily production levels, inventory levels and reject percentages for their specific manufacturing plant.

Senior management, middle management, operational management, data entry staff, shop floor workers, production units, warehouse staff and supply chain partners require different information from business units operating in different parts of the world (Chhai and Lan, 2005). Types of information required can vary from country-specific legal, tax and reporting requirements (Kumar et al., 2008; SAP_AG, 2009) to inventory, production and delivery records (SAP_AG, 2004). Thus, it is important for global organisations to have an information system that can accommodate these multi-level and multi-purpose information requirements. Furthermore, it is important global businesses to have an information system that can support 24-hour data and information processing (Kikuchi and Marjit, 2010). This is because some global businesses carry out their normal activities when others rest due to working in different time zones (Potosky and Olshan, 2008).

2.2.5.2 Accurate and timely information

In global businesses, accurate and timely information is the key to making effective decisions (Bidgoli, 2010), which are characterised by overlapping office hours due to being located in different time zones. Accurate and timely information on global production, profitability, sales and marketing, human resources, inventory, shares, debtors, creditors, expenditure and political issues are essential for effective management (SAP_AG, 2004). This information help make better, faster and more informed business decisions (Bouquet et al., 2009) and enables better coordination, collaboration and control among strategic business units (SBUs) (Peppard, 1999). Furthermore, to serve effectively in each region, SBUs of global organisations need accurate and timely information on changes in demand and other relevant information in their region (Koren, 2010). Moreover, free flow of accurate information within (subsidiaries and departments) and beyond the organisational business units (major customers and suppliers) is imperative to leverage organisational potential in global businesses (ICMR, 2005).

2.2.5.3 Consolidated information

Consolidated information emanating from dispersed business units is also an important requirement for managerial decision-making (Ghosh, 2003). Consolidated reports from all business units are required for the management of production levels, inventory management, sales and marketing strategies, human resource management, expenditure, profitability, tax, assets, liabilities and cash flow management of the group (Mishra, 2009, Hill, 2011). Furthermore, information consolidated from all business processes enables demand management and supports quick decisions (Mishra, 2009; Sannarnes, 2010). For example, in a global organisation if a customer places an order, this information should immediately be delivered to the business units responsible even if they are in different time zones. This information is required by various business units to plan their business activities and processes such as requirement planning, production scheduling, human resource management, financing and accounting, tax planning and marketing. Consolidated information is also important to identify and eliminate duplicated facilities and activities, increase productivity through the integration of manufacturing, marketing, and distribution activities, and exploit new market and business opportunities (Hawking, 2008). It is also critical in meeting the challenges of resource allocation among global business units (Harvey and Novicevic, 2006).

Transformation of different process information into consolidated information is critical for collaborative and smooth running of global business operations (Shang, 2005). Furthermore, since global organisations operate in a number of countries, they must have a sound system to obtain up-to-date information from foreign exchange markets in order to manage foreign exchange risks (Koren, 2010). Absence of consolidated information takes managers a long time to put information together for timely business and management decisions (Huq et al., 2006). Therefore, consolidated information concerning global production, inventory, sales and marketing, human resources, spending, profitability, tax, assets and liabilities and cash flow is an important requirement.

2.2.5.4 Global business process information

Business processes (inventory, human resources, procurement, production, marketing and finance) of global businesses are usually dispersed around the world. Being strongly integrated is a requirement to achieve business success and competitive advantage (Peppard, 1999; Koren, 2010; Sannarnes, 2010). In a global company if a customer places an order, this information should be transmitted to the units responsible in real time. This information is required by various business units to plan their business activities and processes. The procurement department will need this information to order raw materials from suppliers, a production plant will use this information to plan production, and the human resources department will use this information to arrange labour, etc. All of these business processes (units) need to be seamlessly linked in order to exchange critical global business information.

In the global business environment, a firm's competitive position in one country is significantly influenced by its position in other countries (Boudreau et al., 1998). Global organisations need to integrate their business processes on a global basis to achieve competitive advantage (Boudreau et al., 1998). Furthermore, integrated information from global business processes play an important role in leveraging strategic resources (Shi et al., 2010). Effective coordination and collaboration of information from all global business processes are critical for partner relationship management and improved business performance (Shi et al., 2010).

2.2.5.5 Global supply chain information

Global businesses have a large number of collaborators and stakeholders in the supply chain for sourcing as well as for distribution of goods and services (McAdam and McCormack, 2001; Friedman, 2006). All supply chain members require a smooth flow of information for timely supply of raw materials, finished goods and services (Koren, 2010; Shi et al., 2010). In today's competitive global business environment, organisations' success is no longer dependent entirely on their own performance, but rather on the performance of the entire supply chain in which they participate (Arnold et al., 2010). Therefore, it is important for global businesses to share relevant information with all stakeholders, including suppliers, customers, contractors, distributors, retailers, government organisations, capital markets, financial institutions (McAdam and McCormack, 2001) and consumers (Su and Yang, 2010, Hill, 2011).

The need for coordination and integration of the globally distributed supply chain activities is more important for global organisations than local businesses (Hill, 2011). The effective coordination of geographically disperse supply chain partners facilitate timely delivery of products and services (Shi et al., 2010). Global organisations have a much larger and multiple supply chains dispersed over many different countries (Su and Yang, 2010). Therefore, it is crucial for global organisations to have electronic, real-time and accurate supply chain information. Furthermore, such corporations need to maintain a close integrative relationship with business partners not only within themselves but also with external organisations and industries (Kimble, 2011). For instance, Nike has over 600 contract factories in 46 countries (NIke.com, 2011a). Therefore, it is critical for global organisations to have electronic, real-time and accurate supply chain information with regard to material requirement, inventory levels, production scheduling, delivery schedules, employees and sales to improve operational efficiency.

2.2.5.6 Secure information

Secure information is a very important requirement for all global operations (Kajava et al., 2006). Global businesses transfer critical business information to and from their business partners including suppliers, contractors, government organisations and customers electronically (Shew et al., 2003). Therefore, security of information is important to protect data from unauthorised access (Solms and Hertenberger, 2005), and information being intercepted or systems being hacked. These vulnerabilities are high when organisations are interconnected and data is in electronic form (Laudon and Laudon, 2010). In global businesses, ERP systems link with many different business partners worldwide (Shew et al., 2003). Global businesses also transfer critical business information among their business partners electronically via ERP systems. Therefore, security in ERP systems must be able to protect data from unauthorised access (Solms and Hertenberger, 2005), particularly in global businesses where data is transferred electronically (Laudon and Laudon, 2010).

Information security is a significant challenge for global organisations (Kumar et al., 2008). Since they are becoming more and more interconnected and electronically linked to larger supply chains, a lack of information security in one organisation will risk all entities in the value chain (Luftman and Kempaiah, 2008). Thus, for global organisations secure information management with a stringent security policy, disaster recovery plan, business continuity plan and up-to-date security management tools (firewalls, antivirus software, data encryption and public key infrastructure) is essential (Laudon and Laudon, 2010).

2.2.5.7 Other requirements

The other requirements that are important to managing information needs include streamlining business processes (Infosys_Technologis_Ltd, 2010) and information flows (Lehmann, 2006), supporting a centralised environment round the clock facilitating a holistic view from different time zones (Ghosh, 2003), achieve operational excellence (Infosys_Technologis_Ltd, 2010), drive business growth by exploiting new business opportunities in the global arena (Bouquet et al., 2009), building a strong investor relationship with investors around the world (Kumar et al., 2008), managing human resource functions such as payroll, employee self-service, benefits, compensation and reporting on a global basis (House et al., 2008), comply with international and multiple country reporting requirements (Kumar et al., 2008), respond quickly to the changes in external environment (Koh et al., 2006), compete effectively in the global market (Koh et al., 2006), effective management of data warehousing and knowledge management challenges (Lagerstrom and Andersson, 2003; Veli Denizhan, 2008), enhance planning and reporting capabilities (Lehmann, 2006) and protect confidential information with the help of transparent corporate governance policies (Weismann, 2010).

From the above literature review it is clear that multi-level and multi-purpose information from global business units, accurate, timely and consolidated information, global business process information, global supply chain information and secure information are essential requirements for global businesses. Multi-level and multi-purpose information from global SBUs, accurate and timely information and consolidated information are categorised as managerial information while global business process information, global supply chain information and secure information are categorised as operational types of information.

Even though the information requirements of all businesses are very similar, global operations have an added level of complexity due to the large number of entities operating in different time zones and the need for secure information transmission from business units operating in different parts of the world. The complex information requirements of global business operations are increasingly managed by ERP systems (Koumpis and Protogeros, 2010) due to their multi-modular support capabilities. It must also be mentioned that ERP is a large system that can manage large as well as complex operations. The next section reviews and discusses relevant literature on ERP systems.

2.3 Literature review on ERP systems

In the following section, I discuss the relevant literature on ERP systems. Although the origin of ERP systems date back to the 1960s, the literature cited here was mostly published during the last decade. It discusses ERP system modules, reasons why more and more organisations are resorting to ERP systems, how ERP systems can support businesses and prior research done on ERP systems. It also identifies ERP systems capabilities that can meet the information requirements of global businesses. Finally, it presents an analysis of ERP systems capabilities and global business information requirements to propose a research model for improving global business performances.

2.3.1 ERP systems

ERP systems have been described as enterprise-wide information systems that integrate business processes, creating value and reducing costs by delivering timely and correct information to the right people at the right time (McGaughey and Gunasekaran, 2009). Seddon et al. (2010), extended this description of ERP systems as real time, large scale, integrated software systems that use the computational, data storage and transmission power to manage business processes, information flows, reporting and business analysis within and between organisational business units. These systems comprise multi-module applications that can serve and support multiple business functions (Sane, 2005). ERP modules according to Subramoniam et al. (2009) include sales and marketing, accounting and finance, manufacturing and logistics, research and development, suppliers and customers, human resource management, information technology, purchasing, planning and quality control.

Since ERP systems are multi-module software packages, they easily integrate cross-organisational information (Sharif et al., 2005; Gleen, 2008) and support a seamless flow of information between various business functions (Subramoniam et al., 2009). Even though ERP systems are generally referred to as enterprise systems, they are known to be large IT systems (Sheu et al., 2004; Ifinedo, 2008; Ke and Wei, 2008; Chen, 2009; McGaughey and Gunasekaran, 2009; Sammon and Adam, 2010; Seddon et al., 2010; Staehr, 2010) consisting of people, hardware, software, network communication and data. The idea behind an ERP system is to integrate all the business activities into one overarching system (BPP_Learning_Media, 2009b). Providing accurate and timely information are recognised characteristics of ERP systems (Subramoniam et al., 2009) contributing these systems to become underpinning IS technology in many organizations (Morton and Hu, 2008, Sammon and Adam, 2010).

ERP systems are large enough and able to generate a centralised and seamless information flow across various departments (Subramoniam et al., 2009), such as, accounting and finance, manufacturing and logistics, marketing, human resources, research and development, suppliers and customers (Shanks et al., 2000; Sharif et al., 2005; Wang and Chen, 2006; Wang et al., 2008; Kamhawi, 2009). These systems originated in the 1960s and at that time, they were used mainly to handle inventories and master production scheduling (McGaughey and Gunasekaran, 2009). In the 1970s, the system focused on material requirements planning (MRP) and helped to translate master production schedules into the planning of raw material requirements (McGaughey and Gunasekaran, 2009). In the 1980s came the concept of MRP-II, which involved optimising an entire plant's production processes (Jorge et al., 2004). Commercial ERP systems were initiated in 1990 (Sharif et al., 2005), which evolved into ERP II or simply as enterprise systems in the 2000s (Seddon et al., 2010). These systems are now supplied by SAP, Oracle, Sage Group, Infor Global Solutions, Dassault Systems, Siemens PLM and Microsoft (D'Aquila et al., 2009) and are multi-platform entities supported by numerous operating systems such as UNIX, MS Windows NT, Windows 2000, IBM AIX, and HP-UX (Rashid et al., 2002).

2.3.2 Modules of ERP systems

ERP systems comprise a suite of business modules (Sammon and Adam, 2010) supporting management reporting (Davenport, 2000), production management (Esteves and Pastor, 2001), maintenance of plant and equipment (Rashid et al., 2002), transportation management (Rashid et al., 2002), material management (El Amrani et al., 2006), manufacturing management (Rashid et al., 2002, El Amrani et al., 2006), quality management (El Amrani et al., 2006), access controls (SAP_AG, 2007), human resources management (Esteves and Pastor, 2001, Chang et al., 2008), accounting and financial management (El Amrani et al., 2006, Chang et al., 2008), project management (Rashid et al., 2002, McGaughey and Gunasekaran, 2009), procurement management (Chang et al., 2008), advanced planning and scheduling (McGaughey and Gunasekaran, 2009), e-commerce and m-commerce (McGaughey and Gunasekaran, 2009), sales force automation (McGaughey and Gunasekaran, 2009), investment management (Subramoniam et al., 2009), collaborative commerce (Subramoniam et al., 2009), business intelligence (McGaughey and Gunasekaran, 2009, Subramoniam et al., 2009), knowledge management (Subramoniam et al., 2009), customer relationship management (McGaughey and Gunasekaran, 2009, Seddon et al., 2010), supply chain management (Chang et al., 2008, Seddon et al., 2010) and data warehousing (McGaughey and Gunasekaran, 2009, Seddon et al., 2010).

The above discussion clearly indicates that from its inception as a large information system, ERP systems have developed into more capable and more intelligent systems with the ability to support growing new business demands. It is also worth noting that either ERP modules can work as stand-alone units or several modules combined to form an integrated system (Rashid et al., 2002). ERP systems can also be customised to support business requirements and industry best practices (Newman and Westrup, 2005). ERP modules supplied by different ERP vendors have some degree of specialty but the core modules are consistent in their functions (Rashid et al., 2002).

2.3.3 Reason for widespread adoption of ERP systems

ERP systems have been identified as one of the most widespread organisational technology investment projects in the last few decades (Morris and Venkatesh, 2010; Strong and Volkoff, 2010). A number of reasons have contributed to the widespread implementation of ERP systems. These include productivity improvements, greater effectiveness and efficiency, higher customer satisfaction, competitive advantage, improved performance, ease of access to data and information, managing process integration and data redundancy/inconsistency (Buonanno et al., 2005). Furthermore, Subramoniam et al. (2009) state that the external access to information systems of other companies, web readiness of the integrated data and the ability to run on client-server architecture make these systems an important tool in the Internet era.

It is evident that ERP systems are multi-module software packages that offer numerous capabilities and benefits. These are not only important for managing day-to-day business operations but also providing the foundation for future success of modern businesses. Hence, these systems now underpin IS technology in many organisations.

2.3.4 Management of business activities with ERP systems

The following example provided by Sheu et al. (2004) helps us to understand how functionalities offered by ERP systems support business organisations. When a sales person enters an order from any geographical location, ERP system can automatically update the inventory of parts, supplies and production schedules of various organisational units. It facilitates the provision of vital information for numerous departments to complete their jobs. Feedback by the ERP system is usually fast and efficient and makes it possible for the sales person to inform customers about the estimated delivery dates of their order. In addition managers can receive accurate inventory status immediately. From the above it is clear that the ERP systems help plan, manage and coordinate the entire process from receiving an order to delivering the final product or service to the customer.

As discussed earlier, ERP systems offer numerous capabilities and benefits that are central to achieve success in modern businesses. Many organizations recognized ERP systems as an essential tool to be competitive in today's business world (Mzoughi et al., 2008, Mishra, 2009). ERP systems support most of the critical business processes (Jacobson et al., 2007) providing necessary foundation for the future success (Mishra, 2009). It has also been found that the ERP systems form the backbone of business processes (Bogelsack et al., 2010) and provide a positive impact on organisational performance (Mzoughi et al., 2008, Ifinedo et al., 2010). Due to these reasons ERP systems have received significant attention (Aloini et al., 2007) and have become an essential tool in managing business activities of modern businesses (Subramoniam et al., 2009). Hence, many organisations, ranging from manufacturing, retail to service, have been widely adopted these systems (Moon, 2007) to support front end, back end and inter organisational operations (Subramoniam et al., 2009).

2.3.5 Prior research on ERP systems

Many scholars have investigated various research issues related to ERP systems during the last decade. This is evident from the large number of publications in academic journals and conferences. A number of literature review papers were published between 1997 and 2007 on the subject of ERP systems (Esteves and Pastor, 2001; Botta-Genoulaz et al., 2005; Aloini et al., 2007; Esteves and Bohorquez, 2007; Moon, 2007). These publications revealed that the focus of earlier research was on ERP adoption, acquisition, implementation, usage, evolution, retirement, education, risk management, general ERP projects, extension, value, education, trends and perspectives. Other areas of ERP research are presented in Table 2.2.

Table 2-2: Other ERP literature

Category	Literature source
Critical success factors	Bingi, Sharma & Godla 1999; Holland & Light 1999; Sumner 1999; Nah, Lau & Kuang 2001; Somers & Nelson 2001; Akkermans & Van Helden 2002; Zhang et al. 2002; Al-Mashari, M., Al-Mudimigh & Zairi 2003; Bueno & Salmeron 2008; Sammon & Adam 2008; Wang et al. 2008; Gunter & Andrea 2009; Teo et al., 2009; Deghar and Kuzic, 2010; Wickramasinghe and Gunawardena, 2010; Koh et al., 2011.
Revolution	Ross & Vitale 2000.
Cultural issues	Shanks et al. 2000; Soh, Kien & Tay-Yap 2000; Kai 2004; Avison & Malaurent 2007; Ke & Wei 2008.
Implementation	Krumbholz et al. 2000; Parr & Shanks 2000; Al-Mudimigh, Zairi & Al-Mashari 2001; Siau 2004; Vineet 2006; Guido, Lelio & Pierluigi 2007; Yoo, Lyytinen & Berente 2007; Berente, Yoo & Lyytinen 2008; Ke & Wei 2008; Morton & Hu 2008; Chen, JR 2009; Kamhawi 2009; Shepherd, Clegg & Stride 2009; Sammon & Adam 2010; Velcu, 2010.
Evaluation	Stefanou 2001; Häkkinen & Hilmola 2008; Teo, Singh & Cooper 2009; Uwizeyemungu & Raymond 2009.
Benefits	Murphy & Simon 2002; Shang & Seddon 2002; Staehr 2007; Koh, Gunasekaran & Rajkumar 2008; Esteves 2009; Seddon et al., 2010.
Evolution	Rashid, Hossain & Patrick 2002; McGaughey & Gunasekaran 2009.
ERP and E- business	Ash & Burn 2003; Turner & Chung 2006.
Supply chain management	Davenport, Thomas .H. & Brooks 2004; Bose, Pal & Ye 2008; Su and Yang, 2010; Koh et al., 2011; Gunasekaran and Ngai, 2011.
Adoption	Congden, S, Desplaces & Kim 2005; Law & Ngai 2007; Varajao, Trigo & Barroso 2009.
Integration	Sharif, Irani & Love 2005; Koh, Saad & Arunachalam 2006; Bose, Pal & Ye 2008; Kien & Lian 2009.
Cross functional implementation	El Amrani, Rowe & Geffroy-Maronnat 2006.
Impact of ERP systems on firm performance	Cotteleer & Bendoly 2006; Wieder et al. 2006.
Consultants involvement	Wang & Chen 2006; Linying, Derrick & Chris 2009.
Misfit of ERP systems	Wu, Shin & Heng 2007.
ERP in education	Davis & Huang 2007.
Role of managerial agency	Staehr 2008.
User acceptance	Bueno & Salmeron 2008.
Small and medium scale businesses	Esteves 2009.
Top management support	Linying, Derrick & Chris 2009.
Knowledge management	Sedera and Gable, 2010.
Strategic perspectives	Mishra 2009.
Customer relationship management	Bull 2010; Lendel 2009; Sedera & Wang 2009.
Job satisfaction	Morris and Venkatesh, 2010.
Reasons for ERP failures	Kwahk, KY & Ahn 2010.

Table 2.2 indicates that the ERP research - apart from Esteves and Pastor (2001); Botta-Genoulaz et al. (2005); Aloini et al. (2007); Esteves and Bohorquez (2007) and Moon (2007) - has focused on critical success factors, implementation, benefits, evaluation, supply chain management, adoption and integration. Although a recent study (Lu and

Ramamurthy, 2011) addressed IT capability issues in general, the capabilities of specific IT system such as ERP system have not been explored.

2.3.6 ERP systems capabilities

ERP systems can operate on a web enabled architecture (Siau, 2004) supporting e-commerce requirements (Kamhawi, 2009; McGaughey and Gunasekaran, 2009). These systems also support multiple enterprise operations (Siau, 2004; Sane, 2005) with online real time data in all regions of the world, and have the ability to support multiple languages and multiple currencies (Subramoniam et al., 2009) for both intra and extra organisational communication. With the capabilities ERP systems have been recognised as supporting corporate growth (Esteves, 2009), knowledge management (Davenport, 2000), management reporting (Strong and Volkoff, 2010), advanced planning and scheduling (McGaughey and Gunasekaran, 2009), provided scalability to expand (Subramoniam et al., 2009) and elimination of duplication of data (Kwahk and Ahn, 2010).

These systems can also extend business processes to open application architectures (Sharif et al., 2005; Koh et al., 2008), provide vertical functionality (Sharif et al., 2005; Koh et al., 2008), facilitate automation of business processes (BPP_Learning_Media, 2009b), facilitate integration with supply chain members (Sharif et al., 2005; McGaughey and Gunasekaran, 2009), support enterprise (Koh et al., 2008) and global processing requirement (Davenport, 2000, Gunter and Andrea, 2009). They also support strategic and operational information required to plan objectives and day-to-day operations (BPP_Learning_Media, 2009a). Therefore, ERP systems can have broader organisational impacts compared to smaller software packages such as MYOB, ACCPACC, SAGE, QuickBooks and Tally available in the market (Strong and Volkoff, 2010).

An ERP system is a type of information system (IS) (Malhotra and Temponi, 2010; Sammon and Adam, 2010) that includes a large number of modules supporting a suite of business operations. Since ERP systems are multi-modular software packages, they easily integrate cross-organisational information (Sharif et al., 2005; Gleen, 2008) and support a seamless flow of information between various business functions (Subramoniam et al., 2009). These systems provide accurate and timely information (Subramoniam et al., 2009), integrate business processes (McGaughey and Gunasekaran, 2009), manage information flows, and provide reports and business analyses within and between business units (Seddon et al., 2010). The capabilities of ERP systems are discussed in the following section.

2.3.6.1 Support multi-purpose and multi-level information needs

ERP systems support a variety of business operations (Sammon and Adam, 2010), especially in large businesses (Davenport, 2000). ERP systems modules are designed to support production management (Esteves and Pastor, 2001), maintenance of plant and equipment (Rashid et al., 2002), transportation management (Rashid et al., 2002), resource, manufacturing and quality management (El Amrani et al., 2006), access controls (SAP_AG, 2007), human resources management, procurement of raw materials, management reporting (Davenport, 2000), and accounting and financial management (Chang et al., 2008). ERP systems also support project management, advanced planning and scheduling, e-commerce, m-commerce and sales force management (McGaughey and Gunasekaran, 2009), investment management, collaborative commerce, business intelligence, knowledge management (Subramoniam et al., 2009), customer relationship management, supply chain management and data warehousing (Seddon et al., 2010). Furthermore, ERP systems can deliver multi-purpose information needs to employees at different organisational levels including senior management, middle management, operational management, data entry staff, shop floor workers, production units, warehouse staff and supply chain partners (Kumar et al., 2008).

2.3.6.2 Deliver accurate, timely and consolidated information

Accurate, timely and consolidated information are required for sound business decisions and to achieve organisational objectives (Seddon et al., 2010). ERP systems can provide accurate, timely and consolidated information due to their reporting and analytical capabilities (Beheshti, 2006). The source of data is easily identified which enables correction of data before it is transmitted to other sections (Beheshti, 2006). ERP systems are also capable of delivering information to a large number of users simultaneously (Staehr, 2010). Accurate, timely and consolidated information enabled by ERP systems deliver improved information visibility, better management decisions, improved business processes, cycle time reduction and faster financial closing time (Seddon, 2005).

2.3.6.3 Integrated global business process information

ERP systems facilitate transaction processing (Beard and Sumner, 2004), business process integration (Gunter and Andrea, 2009), operate on a web enabled architecture (Siau, 2004), integrate multiple enterprise operations (Sane, 2005), provide real time data and information, incorporate different legal and tax reporting policies, support multiple languages and multi currencies as well as intra and inter organisational communication (Subramoniam et al., 2009). ERP systems integrate various business processes and provide the right information to the right people at the right time (McGaughey and Gunasekaran, 2009). This information is used by manufacturing, retail and service organisations (Moon, 2007), supporting faster transfer of transaction information (Kamhawi, 2009), better financial management (Esteves, 2009) and business reporting (Subramoniam et al., 2009). These systems can also be used to measure performance measurement and support strategic planning (BPP_Learning_Media, 2009b).

2.3.6.4 Manage global supply chain information

ERP systems support supply chains (Mabert et al., 2003; Beheshti, 2006) and have the ability to integrate information from a large number of supply chain partners (Chen and Chou, 2009). Many organisations are now using ERP systems to manage their supply chains (Su and Yang, 2010). ERP system-supported supply chains help track items for timely supplies (Beheshti, 2006) and manage supply chain partner relationships (Nandi and Nayak, 2009). Sharing a large volume of real-time information between supply chain partners is a unique requirement of global business operations (Su and Yang, 2010), which is increasingly supported by ERP systems.

2.3.6.5 Transmit secure information

ERP systems can provide fine-grained security controls in all environments for data transmission (Smets-Solanes and De Carvalho, 2003). ERP systems allow authentication and authorisation for network and communication. They also support data storage, data encryption, control third party access, manage trace and audit logs and digital security (SAP_AG, 2006). ERP systems also support backup, continuity planning, disaster recovery and automatic updating (Linying et al., 2009; Malhotra and Temponi, 2010). Furthermore, ERP systems have a role-based control mechanism where restrictions can be imposed on user transactions, ensuring more control over system security and minimising fraud risks (Khan et al., 2009).

To establish the link between global business information requirements and the ERP systems capabilities, the issues identified above are listed in Table 2.3.

Table 2-3: Global business information requirements and ERP systems capabilities

Global Business Information Requirements	Literature Source	ERP Systems Capabilities	Literature Source
Managerial information		**Management oriented**	
Multi-level information (MLIN)	Grant, 2003; Chhai and Lan, 2005; Power and Sharda, 2009	Support multi-level information (SMLIN)	Sane, 2005; McGaughey and Gunasekaran, 2009; Subramoniam et al., 2009; Seddon et al., 2010
Multi-purpose information (MPIN)	Grant, 2003; Kumar et al., 2008; Power and Sharda, 2009; SAP AG, 2009	Support multi-purpose information (SMPIN)	Siau, 2004, McGaughey and Gunasekaran, 2009; Subramoniam et al., 2009; Seddon et al., 2011
Accurate and timely information (ATIN)	Peppard, 1999; Ghosh, 2003; Hawking, 2008; Mishra, 2009; SAP AG, 2009; Koren, 2010; Hill, 2011	Deliver accurate and timely information (DATIN)	Sharif et al., 2005; Chand et al., 2005; Beheshti, 2006; Seddon et al., 2010
Consolidated information (CIN)	SAP AG, 2004; Mishra, 2009; Hill, 2011	Deliver consolidate information from different units and processes (DCIN)	Seddon, 2005; BPP Learning Media, 2009b; Seddon et al., 2010
Operational information		**Operation oriented**	
Global business process information (GBPIN)	Peppard, 1999; Koren, 2010; Sannarnes, 2010	Integrated global business process information (IGBPIN)	Sane, 2005; Gunter and Andrea, 2009; Seddon et al., 2010
Global supply chain information (GSCIN)	kimble, 2011; Friedman, 2006; Koren, 2010; Turban et al., 2010; Hill, 2011	Manage global supply chain information (MGSCIN)	Shew et al., 2003; Mabert et al., 2003; Beheshti, 2006
Secure information (SIN)	Kajava et al., 2006; Luftman and Kempaiah, 2008; Hitachi Consulting, 2009; Laudon and Laudon, 2010	Transmit secure information (TSIN)	Smets-Solanes and De Carvalho, 2003; Solms and Hertenberger, 2005; Laudon and Laudon, 2010

The summary in Table 2.3 includes a list of global business information requirements and ERP systems capabilities. Based on earlier IT/IS alignment studies (Chan et al., 1997; Sabherwal and Chan, 2001; Croteau and Raymond, 2004; Anthony Byrd et al., 2006; Chan et al., 2006; Dong et al., 2008), it is assumed in this research that if ERP systems capabilities are aligned to global business information requirements, improved global business outcomes will be achieved.

To align ERP systems to global business information requirements, the following section explores the extant literature on the alignment of IT/IS to business.

2.4 IT/IS alignment

Business-IT/IS alignment, as described by Reich and Benbasat (1996, p. 56) is “the degree to which the information technology mission, objectives, and plans support and are supported by the business mission, objectives, and plans”. A number of IT/IS alignment studies (Appendix A) have been undertaken in contexts other than ERP systems. This analysis indicates that the alignment of ERP systems to global business information requirements has not been explored in IT/IS alignment theory.

Business IT alignment according to Henderson and Venkatraman (1991) can be achieved by establishing harmony between four domains of strategic choice: business strategy, information technology strategy, organisational infrastructure and processes and information technology infrastructure and processes. Chan and Huff (1993) further elaborated on the alignment of IS with business for improved IS effectiveness and business performance by linking IS strategy to business strategy. Venkatraman (1989) on the other hand is of the view that the “***alignment/fit***” includes moderation, mediation, matching, gestalts, profile deviation, and co-variation/co-alignment. These perspectives are summarised in Table 2.4, which is adopted from Zigurs and Buckland (1998).

Table 2-4: Alternative perspectives of fit

Perspective	Underlying conceptualization	Description	Example	Reference
1) Fit as matching	matching	A match between two theoretically related variables is defined, without reference to a criterion variable.	A match between strategy & structure enhances administrative efficiency.	Venkatraman, (1989a); Zigurs and Buckland, (1998)
2) Fit as gestalts	Internal congruence	Degree of internal coherence among a set of theoretical attributes. This perspective involves many variables.	The nature of internal congruence among a set of strategic variables differs across "high" and "low" performing firms.	Venkatraman, (1989a); Zigurs and Buckland, (1998)
3) Fit as moderation	Interaction	The impact that a predictor variable has on a criterion variable is dependent on the level of third variable, which is the moderator.	The interactive effects of strategy and managerial characteristics have implications for performance.	Venkatraman, (1989a); Zigurs and Buckland, (1998)
4) Fit as mediation	Intervention	A significant intervening mechanism exists between an antecedent variable and the consequent variable.	Market share is a key intervening variable between strategy and performance.	Venkatraman, (1989a); Zigurs and Buckland, (1998)
5) Fit as profile deviation	Adherence to a specific profile	A profile of theoretically related variables is specified and related to a criterion variable.	The degree of adherence to a specific profile has a significant effect on performance.	Venkatraman, (1989a); Zigurs and Buckland, (1998)
6) Fit as covariation/co-alignment	Internal consistency	A pattern of covariation or internal consistency among a set of underlying theoretically variables.	The degree of internal consistency among a set of underlying theoretically related variables has significant effect on performance.	Venkatraman, (1989a); Zigurs and Buckland, (1998)

Table 2.4 shows that, except for fit as profile deviation (5) and fit as covariation (6), all the other perspectives of alignment/fit do focus on aligning strategy or strategic variables to business. So far, this discussion has established the need to determine the impact of aligning ERP systems capabilities to global business information requirements to improve business performance. Accordingly, Venkatraman’s (1989) co-variation perspective has been identified as the most appropriate concept to establish the “fit” between global business information requirements and ERP systems capabilities. This perspective has been selected on the basis that both ERP systems capabilities and global business information requirements are consistently and mutually dependent in their effect on global business performance, which is more consistent with fit as co-variation. This echoes the arguments of Croteau et al. (2001) and Croteau and Raymond (2004).

Although fit as matching and gestalts in Table 2.4 also explains the match among theoretically related variables, they do not explain business performance (Zigurs and Buckland, 1998). Fit as moderation and mediation explains performance as an outcome of a single predictor, moderator or intervening variable (Zigurs and Buckland, 1998). Fit, as profile deviation is more suitable for testing the effect of environment-strategy co-alignment (Venkatraman, 1989). Global business performance is discussed in the next section.

2.5 Global business performance

It is generally agreed that alignment of IT/IS to business delivers improved business performance (Chan et al., 1997; Dong et al., 2008). Improved business performance in earlier alignment studies referred to improvement in profitability (Chan et al., 1997; Palmer and Markus, 2000; Croteau and Bergeron, 2001; Bergeron et al., 2004; Croteau and Raymond, 2004; Anthony Byrd et al., 2006; Dong et al., 2008; Tallon and Pinsonneault, 2011), business growth (Chan et al., 1997; Palmer and Markus, 2000; Croteau and Bergeron, 2001; Bergeron et al., 2004; Croteau and Raymond, 2004; Dong et al., 2008; Tallon and Pinsonneault, 2011), innovation (Chan et al., 1997), reputation (Chan et al., 1997), productivity (Bergeron et al., 2004), efficiency (Tallon and Pinsonneault, 2011), effectiveness (Bergeron et al., 2004), and customer and employee satisfaction (Chan et al., 1997).

Improvement in profitability is a financial measure contributing to improved organisational profitability and shareholder wealth (Hu and Huang, 2006). It can be achieved through increased return on investments, increased sales and reduction in costs (Van der Zee and De Jong, 1999). Organisational reputation is enhanced by increased customer satisfaction achieved through better customer service (Bostan and Grosu, 2011). Customer satisfaction is an important element in achieving organisational success (Horngren et al., 2012). Learning and growth support business growth, innovation and employee satisfaction (Huang and Hu, 2004). Effective management of internal business processes results in better quality, productivity and business efficiency (Hu and Huang, 2006). Therefore, these performance measures are categorised into four perspectives - financial, customer, learning and growth and internal business process performance as presented in Table 2.5.

Table 2-5: Business performance

Performance measurement item	**BSC grouping**	**Reference**
Increased return on investment	**Financial**	Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006
Increased sales revenue		
Reduced operational costs		
Enhanced company image/reputation	**Customer**	Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006
Increased customer satisfaction		
Improved supplier relationship management		
Enhanced market share	**Learning & growth**	Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006
Improved innovation capabilities		
Enhanced employee satisfaction		
Better inventory management	**Internal business processes**	Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006
Reduction in waste (raw material and finish goods)		
Improved quality of products and services		
Improved organizational productivity		
Improved operational efficiency		

The summary shown in Table 2.5 is similar to Kaplan and Norton’s (1998) balanced scorecard (BSC) performance measurement framework. Research hypotheses derived from the above literature analysis are presented below.

2.6 Research hypotheses

The need to co-align global business information requirements and ERP systems capabilities is clearly presented in Table 2.3. The financial performance outcomes of this alignment included increased return on investment, increased sales revenue and reduced operational costs (Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006). Therefore, it is hypothesised that:

H_1- The co-alignment between global business information requirements and ERP system capabilities positively influence financial performance of global businesses.

Performance outcomes of the co-alignment of global business information requirements and ERP systems capabilities result in enhanced company image/reputation, increased customer satisfaction and improved supplier relationship management (Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006). From the above it is hypothesised:

H_2- The co-alignment between global business information requirements and ERP system capabilities positively influence customer performance of global businesses.

The organisation's ability to innovate, improve and learn is critical for enhancing organisation's value (Kaplan and Norton, 1998). It can be achieved through the ability to introduce new products and services and continual improvements to the existing products, services and processes (Kaplan and Norton, 1998). Learning and growth performance outcomes of the co-alignment of global business information requirements and ERP systems capabilities include enhanced market share, improved innovation capabilities and enhanced employee satisfaction (Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006). Therefore, it is hypothesised:

H_3- The co-alignment between global business information requirements and ERP system capabilities positively influence learning and growth outcomes for global businesses.

Internal business process performance perspective focuses on improving key internal organisational processes that drive the business (Edwards, 2001). Performance outcomes of the co-alignment of global business information requirements and ERP systems capabilities result in reduction in waste, improved quality of products and services, improved organisational productivity and improved operational efficiency (Van der Zee and De Jong, 1999; Huang and Hu, 2004; Hu and Huang, 2006). Therefore, it is hypothesised:

H_4- The co-alignment between global business information requirements and ERP system capabilities positively influence internal business process performance of global businesses.

Balanced scorecard has also been used to evaluate ERP systems performance because it accounts for a wider range of ERP effects compared to traditional financial measures (Rosemann and Wiese, 1999). Using the BSC as a framework Chand et al. (2005), measured the operational, tactical and strategic contributions of ERP systems.

Balanced scorecard has previously been used to measure ERP systems performance in different contexts. The outcomes of this include integration of disparate processes across the organisation, streamlined business processes, transparent flow of information, process efficiencies and improved customer satisfaction (Chand et al., 2005). Better inventory management and manpower planning due to ERP systems contribute to cost reduction and increased customer satisfaction (Chand et al., 2005). The cost reduction achieved through ERP implementation contributes to increased profits. Customer satisfaction achieved through ERP implementation leads to increased sales and market share (Chand et al., 2005).

Previous ERP studies also indicate that there is a positive relationship between investment in ERP systems and performance outcomes (Velcu, 2010; Kallunki et al., 2011). Kallunki et al. (2011) argued that in determining the potential impact of ERP systems, it is important to make a distinction between financial and non-financial performance. This is because financial and non-financial performance improvements achieved from ERP systems may not be achieved simultaneously (Velcu, 2010). Furthermore, Ranganathan and Brown (2006) found that the ERP systems that can support global business requirements (multi-location) have greater potential for improved performance outcomes than single location ERP systems. From the above literature discussion, it is hypothesised that:

H_5- If global business information requirements are effectively managed, improved performance will be achieved.

H_6- If ERP systems adequately support global business information requirements, improved performance will be achieved.

2.7 Moderator variables

While a number of hypotheses have been generated from the literature on global business information requirements and ERP systems capabilities affecting performance, other variables that will moderate performance are organisation size (Sedera et al., 2003; Batenburg and Constantiou, 2009) and the history of globalisation (Kim and Oh, 2000). These variables are discussed in more detail in the following sections.

2.7.1 Organization size

Organisation size indicates the scale of the organisation (Batenburg and Constantiou, 2009) and is generally determined by number of employees (Carpenter and Fredrickson, 2001; Johnson and Lederer, 2010), sales volume (Carpenter and Fredrickson, 2001) and total assets (Carpenter and Fredrickson, 2001).

Organisation size can have an impact on success of ERP projects (Sedera et al., 2003). A number of academic studies have identified that there are significant differences between small and large global organisations (Madapusi and D’Souza, 2008). Thus, there is a need to view the ERP systems employed by small global organisations as different from those of large global organizations (Madapusi and D'Souza, 2005).

Furthermore, researchers have established a strong correlation between company size and ERP adoption and found that there are differences in the ERP selection process adopted by small global organisations and large global organizations (Madapusi and D'Souza, 2007). This may lead to different ERP systems performance outcomes in small and large global organizations (Madapusi and D'Souza, 2007). Kim and Oh (2000) stated that the organisational size is an important moderator variable since the perceived effectiveness of global IT systems can be affected by the absolute size of the firm (Kim and Oh, 2000). Johnson and Lederer (2010) also suggested that the organisation size is a moderator variable and is statistically significant for all dimensions of IT strategic alignment.

The above discussion indicates that organization size will have a moderated effect on global business performance. Therefore, it is hypothesised:

H_{7A}- Financial performance of global businesses is moderated by organisation size.

H_{7B}- Customer performance of global businesses is moderated by organisation size.

H_{7C}- Learning and growth performance of global businesses is moderated by organisation size.

H_{7D}- Internal business process performance of global businesses is moderated by organisation size.

2.7.2 Globalization history

Globalization history refers to the number of years a business has been operating in the global market (Kim and Oh, 2000). Globalization age can be determined from the year when the first foreign subsidiary was established. The IT/IS effectiveness can be influenced by a firm's prior experience with IT/IS use, which in turn can be embodied by the globalization history (Kim and Oh, 2000). Yadong Luo (2001) contends that there is a strong relationship between globalization history and global business performance. The above discussion indicates that globalization history will have a moderated effect on global business performance. Therefore, it is hypothesized.

H_{8A}- Financial performance of global businesses is moderated by globalisation history.

H_{8B}- Customer performance of global businesses is moderated by globalisation history.

H_{8C}- Learning and growth performance of global businesses is moderated by globalisation history.

H_{8D}- Internal business process performance of global businesses is moderated by globalisation history.

The proposed research model drawn from the above hypotheses is presented in the following section.

2.8 Proposed research model

Based on the fourteen hypotheses formulated from the literature review, the following research model is established.

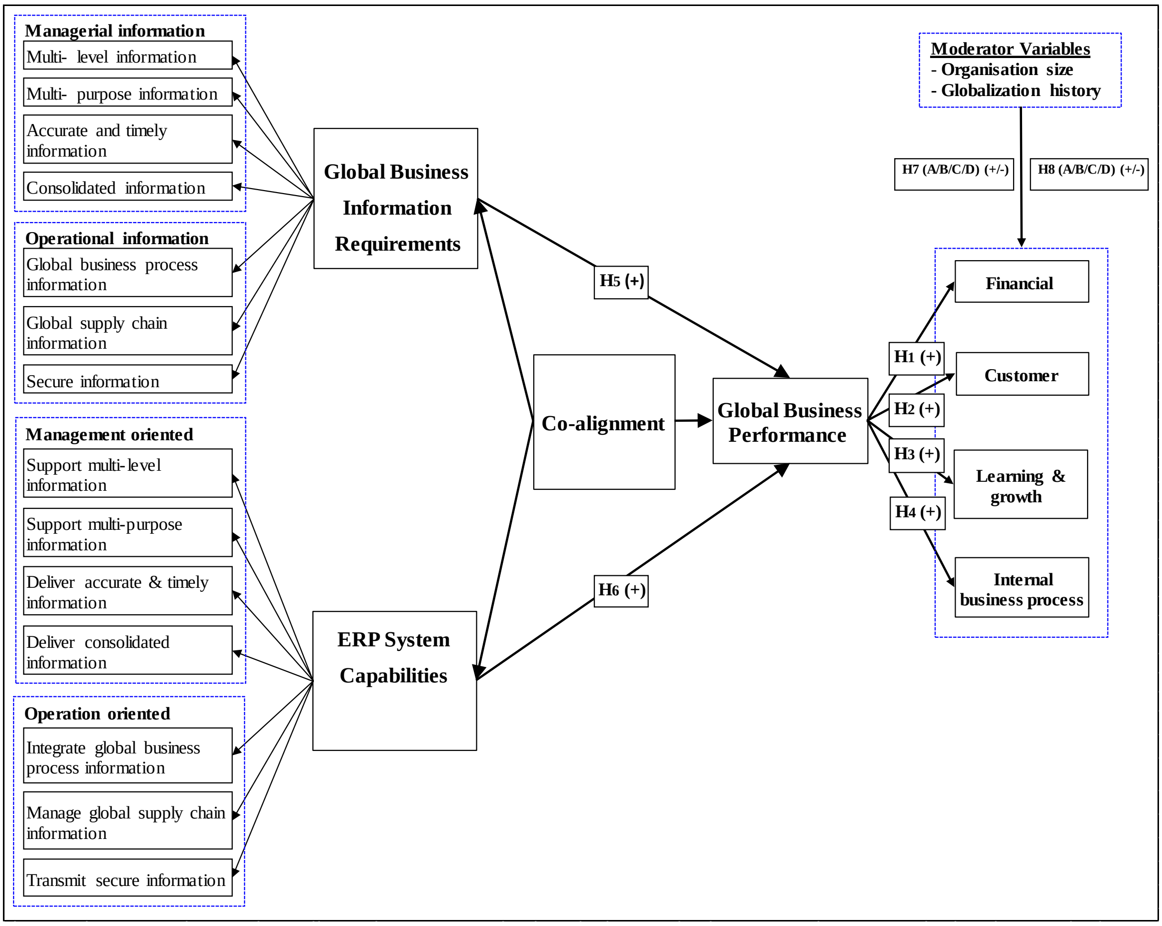


Figure 2-1 : Proposed research model

Figure 2.1 indicates that the proposed research model has three main constructs: global business information requirements, ERP system capabilities and global business performance. It predicts that if ERP systems capabilities are aligned to global business information requirements, improved global business performance outcomes (financial, customer, learning and growth and internal business process) is achieved. These outcomes are influenced by moderator variables such as organisation size and globalisation history.

Global business information requirements and ERP systems capabilities constructs each have seven variables. A global business performance construct has four main variables (financial, customer, learning and growth and internal business process) measured using 14 items identified in Table 2.5. These constructs, variables and items were drawn from previous studies on IT/IS alignment, ERP systems and global business. The applicability of each of these constructs and variables needs to be empirically validated to ensure their validity and practical importance. The next stage focuses on empirically validating the model using an appropriate data collection and analysis technique. First, it will empirically examine whether the global business information requirements identified from the literature can be used in practice. Next, it determines whether ERP systems can support global business information requirements. Finally, it examines the impact of co-aligning global business information requirements and ERP system capabilities on global business performance.

2.9 Summary

Global business is an important business trend in the present economic environment. The number of organisations operating worldwide is on the rise to seek profitable growth opportunities. The reasons for this include competitive advantage, profitable business opportunities, increased worldwide demand for goods and services, deregulation of economic policies and trade barriers, development in ICT, development of the Internet and e-commerce and growth in business process outsourcing.

Managing business operations of global businesses is complex and challenging than the management of local businesses. The challenges faced by global businesses in managing business operations include integration of worldwide business activities, availability of up-to-date and consolidated information, coping with technological challenges, segregation of duties, working in different time zones, maintaining an integrated supply chain relationship, managing cultural differences, dealing with language differences, coping with e-commerce and m-commerce developments, forming strategic alliances and partnerships, integration with government organisations, competitors and customers in many countries and dealing with multiple currencies, accounting standards and reporting guidelines. To overcome these challenges global businesses are heavily relying on integrated information systems such as ERP systems.

ERP systems have the capacity to support information requirements of global businesses. However, how well these systems are aligned with global business information requirements is not very well known. Even though many researchers have explored various other aspects of ERP systems and IT/IS alignment over the last decade, research focusing on alignment of ERP systems capabilities with global business information requirements is yet to be explored.

In order to address this gap in our knowledge, this thesis develops a research model proposing that the co-alignment of ERP systems capabilities and global business information requirements delivers improved global business performance outcomes. The model draws its theoretical foundation from Venkatraman's co-alignment/co-variation perspective of fit. Fit as co-alignment/co-variation perspective has been adopted on the basis that both ERP systems capabilities and global business information requirements are assumed consistent and mutually dependent in their effect on global business performance. The research methodology is described in the next chapter.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter (chapter 2) reviewed extant literature on global business, ERP systems, IT/IS alignment and business performance. Based on the hypotheses derived from the review of literature, a research model to co-align ERP systems capabilities with global business information requirements for improved performance was established and presented in figure 2.1.

This chapter discusses the research methodology adopted to accomplish: *Should ERP systems capabilities be aligned to global business information requirements for improved global business performance?* The chapter begins with a discussion of the research paradigm guiding this research. Then it describes the research process, research design, research plan, research methodology, research strategy, instrument development, pilot study, sampling strategy, ethical considerations, online survey, response rate, and sample profile. The chapter concludes with a discussion of data analysis techniques to be used and a summary of the main points covered.

3.2 Research paradigm

The objective of this research is to determine the impact of aligning ERP systems capabilities to global business information requirements for improved performance. It is confirmatory in nature and aims to test a set of hypotheses and a research model derived by a deductive logic (Neuman, 2011). The confirmatory nature of this research suggests that the most appropriate paradigm is positivism (Saunders et al., 2009). Positivism is an epistemological position that advocates the application of the methods of natural sciences to the study of social reality (Saunders et al., 2009; Bryman and Bell, 2011). It is the oldest and most widely used approach that combines a deductive logic with empirical observations of individual behaviour to identify patterns of associations between theory and research (Neuman, 2011).

Positivist research is reductionistic in nature, usually associated with quantitative data (Polonsky and Waller, 2011) and focuses on examining the causes that influence outcomes (Creswell, 2003; Saunders et al., 2009). In positivist research, the researcher remains independent, as far as possible, from the subject of the study by maintaining an objective stance (Saunders et al., 2009; Polonsky and Waller, 2011). Positivist research also assumes that there are some universal truths that the researcher can identify based on objective description and explanation (Polonsky and Waller, 2011). Furthermore, in positivist research existing theories are used to derive hypotheses. They are tested using empirical data to confirm or refute the theories (Saunders et al., 2009). The selection of a positivist paradigm was made based on the argument that the research hypotheses and research model were developed based on existing literature and hypothesised relationships. These are to be tested with quantitative data to confirm or refute the model (Saunders et al., 2009). The research process used in this thesis is discussed in the next section.

3.3 Research process

This research adopts the research process proposed by Creswell (2012) and Bhattacherjee (2012). This process is depicted in Figure 3.1.

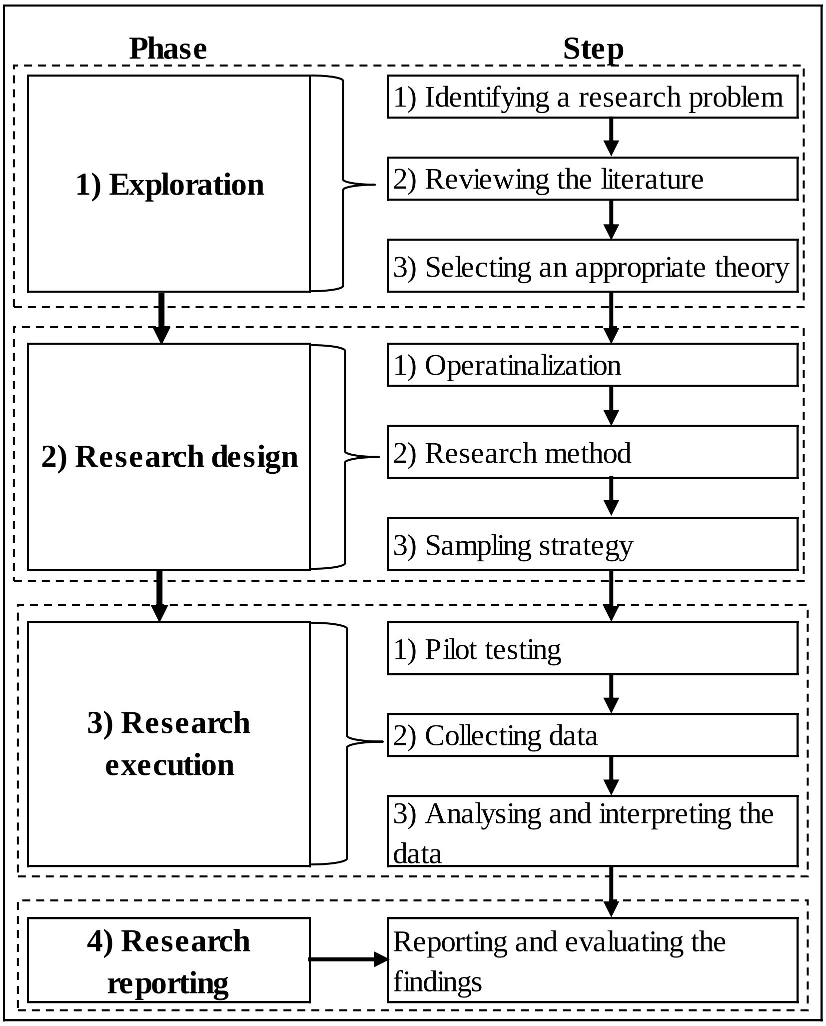


Figure 3-1: Research process

As shown in Figure 3.1, there are four main phases involved in this research process. The first phase is that of exploration and it involves formulating research questions, reviewing extant literature to understand what is currently known and to select an appropriate theory that may be useful for the proposed study. Chapter one (introduction) covered step one of phase one. Steps two and three of phase one were covered in Chapter Two. The primary research question addressed in this research is: Should ERP systems capabilities be aligned to global business information requirements for improved global business performance?

The second phase involves establishing constructs, variables and precise measures to be studied, selecting an appropriate research method and an appropriate sample. These steps are discussed in more detail later in this chapter. The third phase is research execution. It includes pilot testing, data collection, analysis and interpreting results. Pilot testing and data collection are discussed in this chapter and data analysis and interpreting are covered in Chapters Four-Six (data cleaning and demographic statistics, measurement model validation and structural model validation and hypotheses testing). The fourth section of the research process involves discussing the research findings and preparing the final research report. This is presented in Chapter Seven (discussion and conclusion).

3.4 Research design

Research design provides a framework for collecting, analysing, interpreting and reporting data in a research study (Creswell and Clark, 2007; Hair et al., 2011). It is a blueprint or a procedural plan that explains how a research study is to be completed (Thyer, 1993; Punch, 2000; Polonsky and Waller, 2011) or research questions are to be answered (Saunders et al., 2009). Research design sits between the research questions and data, showing how the research questions connect to data, and what tools and procedures are used in answering the research questions (Punch, 2000).

This research is guided by a cross-sectional descriptive research design. The cross-sectional descriptive research design entails collecting data from more than one participant at a single point in time (Hair et al., 2011; Neuman, 2011). This design focuses on examining current attitudes, beliefs, opinions or practices of research participants (Creswell, 2012) and is structured to obtain data to measure the issues described in the research questions (Hair et al., 2011). It required some prior knowledge of the subject and used a structured approach to collect data (Polonsky and Waller, 2011). The collected data is then examined using an appropriate data analysis technique (structural equation modelling) to detect pattern of associations between constructs and variables (Bryman and Bell, 2007, 2011).

3.5 Research plan

Figure 3.2 depicts the research plan for this study. It involves five stages: review of literature and development of initial research model, a survey instrument, a pilot study, a quantitative study and write-up and submission.

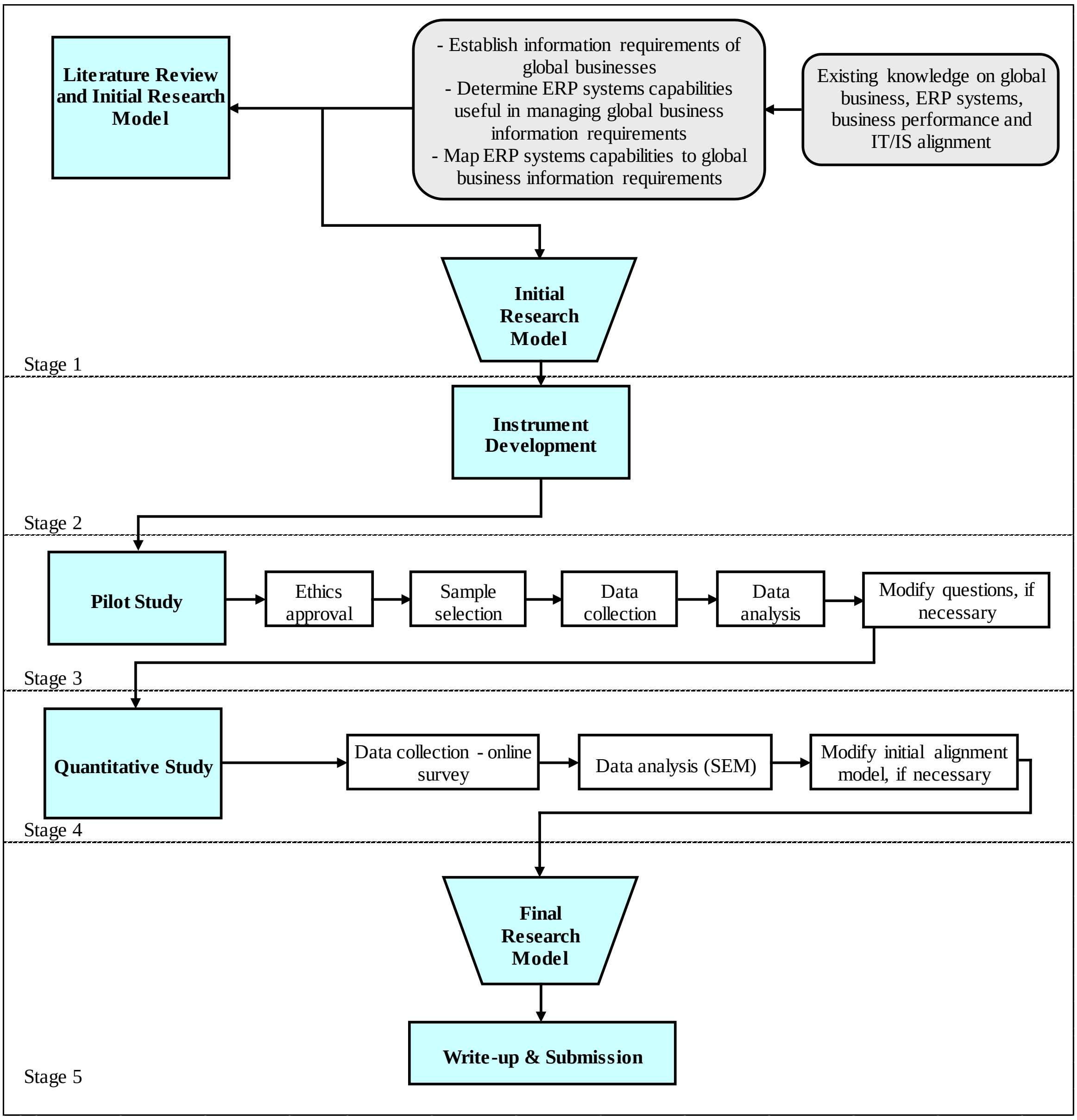


Figure 3-2: Research plan

As shown in Figure 3.2, this research began with an in-depth review of existing literature on ERP systems, global business, business performance and IT/IS alignment. From this literature review the global business information requirements and ERP systems capabilities that can manage global business information requirements were established. It then mapped the ERP systems capabilities to global business information requirements to propose a set of hypotheses and a research model for improving global business performance. Then a survey instrument was developed and pilot tested with 5 PhD students, 7 academics and 2 ERP professionals. Next, a quantitative study was conducted. The quantitative study entailed an online survey of junior, middle and senior managers from global organisations employing ERP systems. Responses from this survey were analysed via the structural equation modelling technique to determine the impact of aligning global business information requirements and ERP systems capabilities on global business performance.

3.6 Research methodology

This research was accomplished via the quantitative research methodology. Quantitative research emphasizes quantification in the collection and analysis of data via a deductive approach to identify the relationship between theory and research (Bryman and Bell, 2011). It incorporates the practices and norms of natural sciences to the study of social reality and embodies a view of social reality as an external objective reality (Pather and Remenyi, 2004; Bryman and Bell, 2007; Bryman, 2008; Bryman and Bell, 2011). It entails the collection of numerical data and exhibits the relationship between theory and research as deductive (Bryman and Bell, 2007, 2011). The quantitative studies rely on positivist principles and emphasise measuring variables and testing hypotheses (Neuman, 2011). It involves collecting data from a large number of respondents and then the results are projected to represent a larger population (Polonsky and Waller, 2011).

This research follows the ten-step process proposed by Bryman and Bell (2007, 2011). The sequence of steps along with the chapters where each of these steps are covered is presented in Figure 3.3.

Process	Chapter
1. Theory	Chapter - 2
2. Hypotheses	Chapter - 2
3. Research design	Chapter - 3
4. Devise measures of concepts	Chapter - 3
5. Select research sites	Chapter - 3
6. Select research respondents	Chapter - 3
7. Collect data	Chapter - 3
8. Process data	Chapter - 4/5
9. Analyse data	Chapter - 4/5/6
10. Findings/ conclusions	Chapter - 6/7

Figure 3-3: Ten-step process of quantitative research

The above figure summarises the processes involved in this research and their interconnections in corresponding chapters of the thesis. It starts with a discussion of theory and formulation of research hypotheses. The generation of ideas was based on extant literature. Then it discusses research design, constructs, variables and indicators, selecting suitable participants, data collection, processing and analysis. The final step in the process is a discussion of research findings and conclusions.

3.7 Research strategy

The research strategy guiding this research is the online survey. It used an online questionnaire to collect data from a large number of respondents at a single point in time (Bryman and Bell, 2007, 2011; Neuman, 2011). Advantages of online survey are cost effectiveness, convenience and quick responses (Singh and Burgess, 2007). Online survey method allows collecting data from organisations situated in many different geographical locations (Singh and Burgess, 2007; Creswell, 2012) such as global businesses. This method is popular due to the increased use of websites and the Internet by individuals and businesses (Creswell, 2012) and especially useful for users of technology (ERP systems).

3.8 Nomological network of constructs

Prior to developing a research instrument, it is very important to understand constructs, variables and indicators involved in a research model. A visual image of the relationship between constructs, variables and indicators (network of relationship) provides a very useful guide to how a study may proceed. The overall network of relationships between a set of related constructs is called a nomological network (Bhattacherjee, 2012). The nomological network of constructs (relationships) of this research is presented in Figure 3.4.

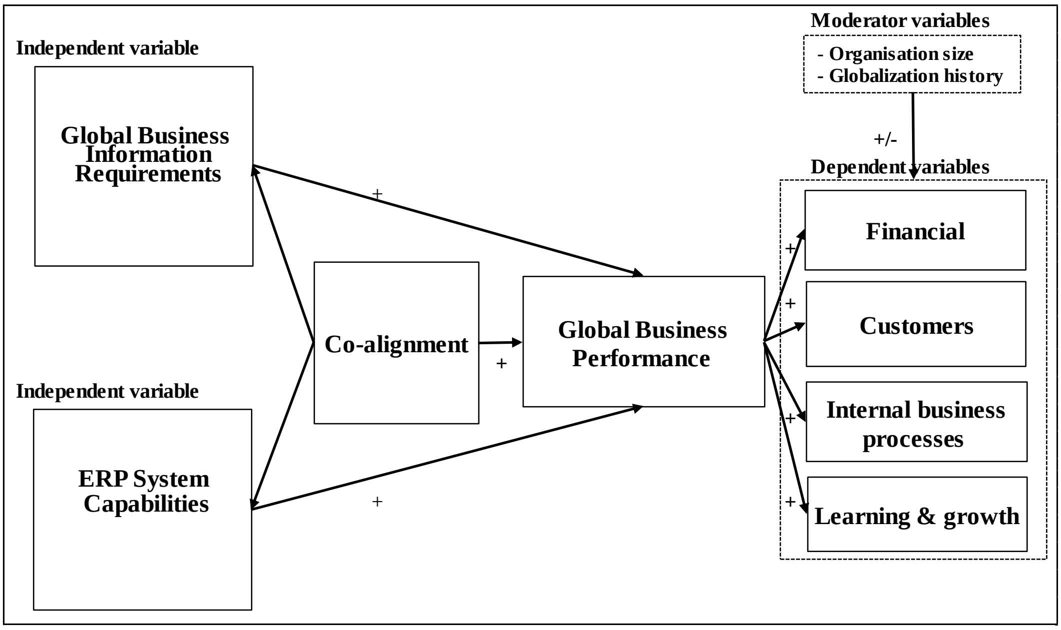


Figure 3-4 : Nomological network of constructs

Figure 3.4 shows the relationships between different variables in the proposed research model. It postulates that the co-alignment of global business information requirements and ERP systems capabilities positively influence global business performance, which is measured through four different perspectives, namely: financial, customers, learning and growth and internal business processes. Three main constructs of the model are: global business information requirements, ERP systems capabilities and global business performance. Measures of global business information requirements and ERP systems capabilities are independent variables, while global business performance is the dependent variable. Organisation size and globalisation history are the moderator variables. How the research instrument was developed is discussed in the next section.

3.9 Instrument development

This section discusses the instrument development. The instrument (Appendix B.1) has four main sections. Section one covers demographic data and sections two to four contain empirical measurements of three main constructs - global business information requirements, ERP systems capabilities and global business performance (see Figure 2.1).

Section one (Q1 to Q16) determined if the organisation has global operations and uses ERP systems, number of countries it operates in, globalisation history, country of ownership, type of industry, annual turnover, number of employees, business unit/subsidiary the respondent works in and his/her position. Section two (Q17 to Q51) collects data on global business information requirements by presenting these as identified from the literature review. Section three (Q52 to Q79) collects data to determine ERP systems capabilities that are important in managing information requirements. Section four (Q80 to Q93) collects data necessary to determine the impact of co-aligning ERP systems capabilities and global business information requirements for business performance. These questions were presented on a five-point Likert scale (‘‘strongly disagree’’ (1) to ‘‘strongly agree’’ (5)). Development of the three main constructs of the research model is discussed below.

3.9.1 Global business information requirements construct

The global business information requirements (GBIR) construct was measured using seven reflective variables: multi-level and multi-purpose information from global business units; accurate, timely and consolidated information; global business process information; global supply chain information; and secure information. Each variable was measured using multiple reflective items. Reflective indicators are caused by the latent constructs, are interchangeable, they co-vary, and share a common theme (Jarvis et al., 2003; Lu and Ramamurthy, 2011). A five-point Likert scale approach was used to collect responses to questions. It also included a not applicable option to minimise the risk of obtaining inaccurate responses from participants (Barua et al., 2004). Table 3.1 presents the question items for each of the variables of global business information requirement construct along with their source.

Table 3-1: Questions concerning the GBIR construct

Item	Variable	Question item	Reference
MLIN - 1	Multi-level information	1. Real-time information from all business units is required for decision making at the head office	Chhai and Lan, 2005
MLIN - 2		2. Real-time information from all functional departments is required for decision making at SBUs	Chhai and Lan, 2005
MLIN - 3		3. Information requirements of the top management are different from that of middle and operational management	Grant, 2003, Power and Sharda, 2009
MLIN - 4		4. Information requirements of the middle management are different from that of top and operational management	Grant, 2003, Power and Sharda, 2009
MLIN - 5		5. Information requirements of non-managerial employees are different to the managerial employees	Grant, 2003, Power and Sharda, 2009

1	MPIN - 1	Multi- purpose information	6. Detailed as well as summarised information from different business functions is required for quick decision making	Grant, 2003, Power and Sharda, 2009
2	MPIN - 2		7. Independent information from different SBUs is required for decision making	Power and Sharda, 2009
3	MPIN - 3		8. Real time information is required for legal reporting requirements in different countries	Power and Sharda, 2009
4	MPIN - 4		9. Real time information is required for tax payment needs in different countries	Kumar et al., 2008, SAP AG, 2009
5	MPIN - 5		10. Real-time information is required to maintain a strong relationship with investors in different countries	Kumar et al., 2008, SAP AG, 2009
3	ATIN - 1	Accurate and timely information	11. Real-time production related information is required for production planning	Hawking, 2008, Bouquet et al., 2009
4	ATIN - 2		12. Real-time inventory information is important for inventory management in different SBUs	SAP AG, 2004; Hawking, 2008; Bouquet et al., 2009
5	ATIN - 3		13. Real-time sales information is important for revenue management and marketing	SAP AG, 2004; Hawking, 2008; Bouquet et al., 2009
6	ATIN - 4		14. Real-time spending information is important for cash flow planning	SAP AG, 2004; Hawking, 2008; Bouquet et al., 2009
1	CIN - 1	Consolidated information	15. Consolidated information is important for managing business operations effectively	SAP_AG, 2004; Mishra, 2009; Hill, 2011
2	CIN - 2		16. Consolidated information on different issues is required for decision making	SAP_AG, 2004; Mishra, 2009; Hill, 2011
3	CIN - 3		17. Consolidated information is required for foreign exchange management	Mishra, 2009; Koren, 2010; Hill, 2011
4	CIN - 4		18. Consolidated information is critical for planning	Mishra, 2009; Hill, 2011
5	CIN - 5		19. Consolidated information is critical for budgeting	SAP_AG, 2004; Mishra, 2009; Hill, 2011
1	GBPIN - 1	Global business process information	20. Integrated information is required for coordinating production processes on a global basis	Peppard, 1999, Koren, 2010, Sannarnes, 2010
2	GBPIN - 2		21. Integrated information is required for managing inventory on a global basis	Peppard, 1999, Koren, 2010, Sannarnes, 2010
3	GBPIN - 3		22. Integrated information is required for coordinating procurement on a global basis	Peppard, 1999, Koren, 2010, Sannarnes, 2010
4	GBPIN - 4		23. Integrated information is required for managing finance & accounting functions on a global basis	Peppard, 1999, Koren, 2010, Sannarnes, 2010
5	GBPIN - 5		24. Integrated information is required for managing human resources on a global basis.	Peppard, 1999, Koren, 2010, Sannarnes, 2010
6	GBPIN - 6		25. Integrated information is required for collaborating with global supply chain partners	Piccoli 2008; Dao et al. 2011; Turban et al., 2010
7	GBPIN - 7		26. Integrated information is necessary for global project management	Boudreau et al., 1998; Laudon and Laudon, 2010

GSCIN- 1	Global supply chain information	27. Real-time information sharing with supply chain partners is critical for improved operational efficiency	Turban et al., 2010, p 288
GSCIN- 2		28. Real-time information sharing with supply chain partners is critical for delivering better service to customers	Turban et al., 2010, p 289
GSCIN- 3		29. Timely and accurate information exchange with supply chain partners is important to minimize inventory levels	Su and Yang, 2010
GSCIN- 4		30. Timely and accurate information exchange with supply chain partners is important to optimize production process	Turban et al., 2010, p 289
GSCIN- 5		31. Timely and accurate information exchange with supply chain partners is important to reduce cost associated with supply chain activities	Turban et al., 2010, p 289
INS - 1	Information security	32. Information security is important to combat unauthorised access	Luftman and Kempaiah, 2008
INS - 2		33. For secure information exchange the organization has adequate information security policies in place	ITGI, 2003, Broadbent and Kitzis, 2005
INS - 3		34. Information security controls (Eg: password, firewall, antivirus software, data encryption and disaster recovery procedure) are essential for information management	ITGI, 2003
INS - 4		35. Information security policies, procedures and controls are regularly reviewed and updated	ITGI, 2003

Table 3.1 indicates that the variables for global business information requirements construct were measured using multiple items. For instance, the multi-purpose information variable was measured using five items: detailed and summarised information, independent information from global strategic business units (GSBUs), information related to legal reporting, tax planning and investor relationship management. Similarly, to evaluate the importance of other global business information requirements more than four items are used and these originated from previous studies.

3.9.2 ERP systems capabilities construct

The ERP systems capabilities (ERPSC) construct was measured using seven reflective variables, namely: supporting multi-level information; supporting multi-purpose information; delivering accurate and timely information; delivering consolidate information; integrating global business process information; managing global supply chain information; and transmitting secure information. Every variable was measured using multiple reflective items. Answers to the questions were collected on a five-point Likert scale varying from ‘‘strongly disagree’’ (1) to ‘‘strongly agree’’ (5). A not applicable option (“0”) was included for each question to minimise the risk of obtaining inaccurate responses. Table 3.2 presents the question items for each of the variables of ERP systems capabilities construct.

Table 3-2: Question concerning the ERPSC construct

Item	Variable	Question item	Reference
SMLIN -1	**Support multi-level information**	1. Real-time information requirements of the head office are supported by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMLIN -2		2. Real-time information requirements of SBUs are supported by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMLIN -3		3. Information requirements of the top management are supported by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMLIN -4		4. Information requirements of the middle management are supported by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMLIN -5		5. Information requirements of non-managerial employees are supported by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMPIN -1	**Support multi-purpose information**	6. Detailed as well as summarised information required for decision making are provided by ERP system	Subramoniam et al., 2009; Seddon et al., 2010
SMPIN -2		7. Independent information required for decision making is provided by ERP system	Siau, 2004, Sane, 2005; McGaughey and Gunasekaran, 2009
SMPIN -3		8. Real time information required for legal reporting requirements in different countries is supported by ERP system	Siau, 2004, Sane, 2005; McGaughey and Gunasekaran, 2009
SMPIN -4		9. Real time information required for tax payment needs in different countries is supported by ERP system	Siau, 2004, Sane, 2005; McGaughey and Gunasekaran, 2009
SMPIN -5		10. Real-time information required for maintaining a strong relationship with investors in different countries is supported by ERP system	Siau, 2004, Sane, 2005; McGaughey and Gunasekaran, 2009
DATIN - 1	**Deliver accurate & timely information**	11. Real-time production related information required for production planning is supported by ERP system	Sharif et al., 2005; Gleen, 2008
DATIN - 2		12. Real-time inventory information required for inventory management in different SBUs is supported by ERP system	Staehr, 2008
DATIN - 3		13. Real-time sales information required for revenue management and marketing is supported by ERP system	Seddon et al., 2010
DATIN - 4		14. Real-time spending information required for cash flow planning is supported by ERP system	Klaus et al., 2000; Gunter and Andrea, 2009

1	DCIN - 1	Deliver consolidated information	15. Consolidated information required for managing business operations is supported by ERP system	Sharif et al., 2005; McGaughey and Gunasekaran, 2009
1	DCIN - 2		16. Consolidated information required for decision making is supported by ERP system	Rashid et al., 2002; Oliver and Romm, 2002
1	DCIN - 3		17. Consolidated information required for foreign exchange management is supported by ERP system	Kumar et al., 2008; Hakkinen and Hilmola, 2008
1	DCIN - 4		18. Consolidated information required for planning is supported by ERP system	McGaughey and Gunasekaran, 2009
1	DCIN - 5		19. Consolidated information required for budgeting is supported by ERP system	Smets-Solanes and De Carvalho, 2003;Bull, 2010
1	IGBPIN - 1	Integrate global business process information	20. Integrated information required for coordinating production processes on a global basis is supported by ERP system	Subramoniam et al., 2009
1	IGBPIN - 2		21. Integrated information required for managing inventory on a global basis is supported by ERP system	Klaus et al., 2000, Gunter and Andrea, 2009
1	IGBPIN - 3		22. Integrated information required for global project management is supported by ERP system	Rashid et al., 2002, McGaughey and Gunasekaran, 2009
	IGBPIN - 4		23. Integrated information required for managing finance & accounting functions on a global basis is supported by ERP system	Staehr, 2007
	IGBPIN - 5		24. Integrated information required for managing human resources on a global basis is supported by ERP system	Staehr, 2008
	MGSCIN - 1	Manage global supply chain information/ transmit secure informatio	25. Integrated information required for collaborating with global supply chain partners is supported by ERP system	Sharif et al., 2005; McGaughey and Gunasekaran, 2009
	MGSCIN - 2		26. Integrated information required for coordinating procurement on a global basis is supported by ERP system	Rashid et al., 2002, McGaughey and Gunasekaran, 2009
	MGSCIN - 3		27. Real-time information sharing with supply chain partners is supported by ERP system	Sharif et al., 2005; McGaughey and Gunasekaran, 2009
	TSIN - 1		28. Information security control (Eg: password, firewall, antivirus software, data encryption and disaster recovery procedure) initiatives are supported by ERP system	Kumar et al., 2008; Hakkinen and Hilmola, 2008

Table 3.2 shows that the variables for the ERP systems capabilities construct have been measured using multiple items. They were mainly derived from existing studies.

3.9.3 Global business performance construct

The global business performance (GBPER) construct was measured using fourteen performance outcome items. Answers to the questions for this construct were collected on a five-point Likert scale varying from ‘‘strongly disagree’’ (1) to ‘‘strongly agree’’ (5). A non-applicable option ("0") for each question was included to minimise the risk of obtaining inaccurate responses. Table 3.3 displays the question items for these variables.

Table 3-3: Questions concerning the GBPER construct

Item	Variable	Question item	Reference
FINP - 1	Financial perspective	1. Increased return on investment	Chan et al., 1997; Chan, 2001
FINP - 2		2. Increased sales revenue	Chan et al., 1997; Chan, 2001; Croteau and Raymond, 2004
FINP - 3		3. Reduced operational costs	Chan et al., 1997
CUSP - 1	Customer perspective	4. Enhanced company image/reputation	Chan et al., 1997; Chan, 2001
CUSP - 2		5. Increased customer satisfaction	Chand et al., 2005
CUSP - 3		6. Improved supplier relationship management	Chand et al., 2005
LGP - 1	Learning and growth perspective	7. Enhanced employee satisfaction	Chand et al., 2005
LGP - 2		8. Improved innovation capabilities	Xiao and Dasguptay, 2009
LGP - 3		9. Enhanced market share	Chan et al., 1997; Chan, 2001; Croteau and Raymond, 2004
IBPP - 1	Internal business process perspective	10. Better inventory management	Cotteleer and Bendoly, 2006
IBPP - 2		11. Reduction in waste (raw material and finish goods)	Chand et al., 2005
IBPP - 3		12. Improved quality of products and services	Chand et al., 2005
IBPP - 4		13. Improved organizational productivity	Chan, 2001; Raymond and Croteau, 2009
IBPP - 5		14. Improved operational efficiency	Chan, 2001; Cotteleer and Bendoly, 2006

As shown in Table 3.3 four variables for the global business performance construct were measured using fourteen items to document the performance of global businesses supported by ERP systems.

3.9.4 Moderator variables

The model consists of two moderator variables, namely organisation size and globalisation history. Organisation size was measured using annual turnover and number of employees in the group. Globalization history was measured using the number of years that the business has operated in the global arena. Overall the model has fourteen independent variables, four dependent variables and two moderating variables. In total, 77 items were used to measure all the variables in the model.

3.10 Pilot study

Conducting a pilot study is important not only to ensure that the survey questions function well but also to confirm that the research instrument is valid (Bryman, 2008). It also allows researchers to understand that the respondents will understand research questions correctly (Creswell, 2012). It is very important and particularly so in self-completion questionnaires as there is no interviewer present to resolve any confusion that may occur at the time of completing the survey (Bryman, 2008). A pilot study with 5 PhD students, 7 academics and 2 ERP professionals was conducted to establish the validity and understanding of the questions included in the survey instrument. A few changes were made to the questionnaire based on the responses of the pilot study before it was uploaded to the survey monkey server.

3.11 Sampling strategy

Sampling is a statistical process of selecting a subset of a population of interest in order to make observations and statistical inferences about that population (Bryman, 2008; Hair et al., 2011; Bhattacherjee, 2012). Population is the universe of units from which the sample is to be selected (Bryman, 2008). In social science research, it is impractical to study the entire population due to feasibility and cost constraints (Bhattacherjee, 2012). Therefore, it is important to select a representative sample from the population of interest for observation and analysis (Bhattacherjee, 2012). This section presents sample size, sampling techniques and the selection criteria employed in selecting respondents for this study.

3.11.1 Sample size

The decision about the sample size is a subjective matter and there is no one definitive answer for that (Bryman and Bell, 2007, 2011). However, decisions about sample size are mainly affected by considerations such as availability of time and resources (Bryman and Bell, 2007, 2011), need for precision (Bryman and Bell, 2007, 2011), type of population (Sarantakos, 2005), type of methodology employed (Sarantakos, 2005), the aim of the research (Sarantakos, 2005) and the type of instruments used (Sarantakos, 2005).

Larger samples are more expensive and time-consuming while smaller samples do not support generating valid conclusions (Hair et al., 2010). SEM-based data analysis techniques require a minimum of 50 responses and sample size should be more than 100 (Hair et al., 2010). Therefore, determining the right sample size is a very important step even for selecting an appropriate data analysis technique. To determine a suitable sample size, this study uses the following formula (Lind et al., 2005).

$$\boxed{\mathrm{n} = p\,(1\text{-}p\,)\left(\frac{\mathrm{z}}{\mathrm{E}}\right)^2}$$

n = sample size, p = population, z = t value for confidence interval, E = sampling error.

This study sets the percentage of confidence level as 96% (z = 2.054). As the population is not known, the percentage of population is set as 50% (p = 0.5). Margin of error is set at 0.04 (E = 0.04). Based on the above calculation, this study requires a sample size of at least 630 managers. Thus, a sample of 700 managers was selected from Internet directories, company websites and personal contacts.

3.11.2 Sampling technique

Purposive and self-selection sampling methods were used to select the sample. Purposive sampling is a non-probability sampling method where it uses the judgement of the researcher in selecting the sample with a specific purpose in mind (Sarantakos, 2005; Hair et al., 2011; Polonsky and Waller, 2011). It focuses on selecting a sample based on known characteristics and ease of accessibility (Polonsky and Waller, 2011). Self-selection sampling is a method that allows respondents to choose whether they wish to participate or not (Saunders et al., 2009). In this research, the researcher determined if the organisation used ERP systems and was global. Prior to circulating the questionnaire, company websites and published annual reports were investigated to verify whether these organisations have ERP systems and operate on a global basis. The respondents were given the option of not participating in the survey if they wished.

3.11.3 Respondents' selection criteria

The target population for this study consists of junior, middle and senior managers with ERP systems experience in a global business, assuming that they are the best people to understand information requirements and capabilities offered by ERP systems. The sample included managers from organisations with the following characteristics.

1) Target managers have to be from organisations operating on a global scale.

2) Target managers have to be from organisations that use ERP systems to manage their global operations.

It is apparent from the above that the sample selection in this study involves certain level of judgement and investigation about the organisation and participants' experience prior to including in the sample. Therefore, the most suitable sampling methods were the purposive and self-selection methods. Hence, this research adopted purposive and self-selection sampling methods to select a suitable sample of global business managers with ERP system experience. Furthermore, this research selected individuals and not the "key informants" or "proxy" of participating organisations particularly to minimise respondents' bias (Bhattacherjee, 2012).

After a careful consideration, a sample of 700 global business managers with ERP system experience was selected to participate in the survey. An e-mail invitation was sent to these managers asking them to take part in the proposed research. Furthermore, a request was made to circulate the questionnaire to other functional managers in their company.

3.12 Ethical considerations

Ethics approval for this research project was obtained from the RMIT Human Research Ethics Committee. Research was conducted according to the guidelines set by the RMIT Ethics Committee. A plain language statement (Appendix B.4), which indicates general guidelines and contact details of RMIT Human Research Ethics committee, was submitted along with the survey questionnaire. Furthermore, respondents' anonymity was protected by the system assigning a number to each returned questionnaire (Creswell, 2012).

3.13 Online survey

The online survey method was used to circulate the questionnaire among managers in global businesses. This technique was selected because it allows to access respondents particularly from organisations in different geographical locations (Gutierrez et al., 2007; Bryman, 2008). There are two ways to administer online surveys: by email (email survey) and via the World Wide Web (web survey). Online surveys offer potential benefits and deliver higher response rates than postal surveys (Zhang, 2000; Bryman, 2008). Online surveys are more suitable when resources are limited and the target population suits an electronic survey (Bryman, 2008).

Since the focus of this study is global businesses in different parts of the world, a large-scale online survey was used to collect data. Data was collected using the "survey monkey" web based survey tool. The online version of the survey was stored in the host server of surveymonkey.com. Respondents were invited to visit the website in which the questionnaire was posted. The invitation (Appendix B.3) was communicated mainly via e- mails. In total, 700 e-mails together with URL reference to the online survey were sent to managers in 200 global companies. URL reference to the survey was provided in the invitation e-mail as well as in the plain language statement (Appendix B.4) sent as an attachment to the e-mail massage. In order to obtain more responses, participants were requested to share the URL of the survey with other people in their workplace. Confidentiality of the responses was guaranteed and the summary of findings was offered as an incentive for respondents. Response rate and the sample profile are presented in the next section.

3.14 Response rate

Data collection was done from July to September 2011. The survey was distributed to 700 managers including directors, CEOs, CIOs, vice-presidents, general managers, senior managers, department managers and junior managers, all of who were in charge of ERP systems in global organisations. Out of 700 online surveys, 21 were returned undelivered. Within two weeks, 119 responses were received. A reminder e-mail was sent to the participants by the end of the 2nd week. Week 6, 200 responses were received. The final reminder e-mail was sent to the respondents by the end of week 6. At the end of week 12, a total of 217 responses were received. A total of 11 questionnaires were incomplete, 5 did not have global business operations and 5 did not have an ERP system, yielding a response rate of 29.3%. The final net sample size is 689 (700-10-11).

$$\text{Response rate} = \frac{217-10-11}{700-21-10} * 100 = 29.3\%$$

3.15 Sample profile

Table 3.4 presents the sample profile.

Table 3-4: Sample profile

Sample profile					
Industry Sector	**Frequency**	**Percent**	**Position**	**Frequency**	**Percent**
Manufacturing & trading	100	51%	Senior Manager	69	35%
Agriculture, forestry & fishing	24	12%	CIO	33	17%
Services	15	8%	General Manager	32	16%
Gas and Electricity	13	7%	Department Manager	24	12%
Communications	12	6%	Junior Manager	23	12%
Finance and insurance	10	5%	CEO	9	5%
Construction	7	4%	Director	2	1%
Mining	6	3%	Vice president	1	1%
Others	9	5%	Chairman	1	1%
Other industries include transportation, tourism, research & development and ICT			Missing	2	1%
Annual turnover	**Frequency**	**Percent**	**No. of employees**	**Frequency**	**Percent**
< $1Mn	1	1%	0-100	2	1%
$1-$9Mn	7	4%	101-200	13	7%
$10-$99Mn	27	14%	201-500	38	19%
$100-$199Mn	37	19%	501-1000	36	18%
$200-$499Mn	26	13%	1001-5000	37	19%
$500-$999Mn	51	26%	5001-9999	36	18%
> $1000Mn	47	24%	> 10000	34	17%

Table 3.4 shows that the responding firms were from a wide range of industries, the majority being manufacturing and trading (51%) businesses. Most respondents were senior managers, CIOs and general managers (68%). The rest included department managers (12%), junior managers (12%), CEOs (5%), directors (1%), a vice-president and a chairman. Over 95% of the organisations had an annual turnover exceeding 10 Mn Australian dollars (AUD). More than 80% of participating organisations had been operating globally for more than 11 years. This provides confidence in the fidelity of the survey responses (Lu and Ramamurthy, 2011).

3.16 Data analysis

Quantitative data gathered in a raw form convey very little meaning and has to be converted into meaningful information using an appropriate data analysis technique (Saunders et al., 2009). Quantitative data can be analysed using statistical tools in two different ways namely descriptive analysis and inferential analysis (Bhattacherjee, 2012). Descriptive analysis refers to statistically describing, aggregating and presenting the relationships between constructs. Inferential analysis denotes statistical testing of hypotheses (structural analysis) (Bhattacherjee, 2012). The analyses used in this research are discussed in more detail in the next three chapters. Data analysis techniques include creating simple tables, diagrams and indices through establishing statistical relationships between variables to complex statistical modelling (Saunders et al., 2009). This research followed Creswell's (2012) four-step process for data analysis. It first completed data examination and cleaning. Then demographic statistics were examined followed by more sophisticated analysis to test the hypotheses, confidence intervals and effect sizes. Finally, research findings and implications are discussed.

Structural equation modelling (SEM) was used to analyse data as this research involves a testing of multiple relationships of dependent and independent variables (Hair et al., 2010). The statistical software IBM SPSS statistics version 19, IBM SPSS AMOS version 19 and Microsoft Excel 2010 version were employed to analyse data. Simple as well as complex statistical techniques were utilised to test the proposed hypotheses and validate the research model. Prior to analysing the data the data was coded in an easy-to-understand format (Neuman, 2011). Then it is entered into SPSS statistical software.

Furthermore, coded data has been verified and coding errors have been rectified. The detailed discussion of the quantitative data analysis is covered in Chapters 4 and 5.

3.17 Summary

This chapter discussed the methodology for answering the research questions and validating the proposed research model. Positivism was the underlying philosophy guiding this research. The quantitative research approach was carried out to validate the proposed research model. Purposive and self-selection sampling techniques were utilised to select a suitable sample. Survey strategy emerged as the best data collection method and SEM was used to analyse data because the research model involves testing multiple relationships of dependent and independent variables. The data cleaning and demographic statistics are discussed in the next chapter.

CHAPTER 4. DATA CLEANING AND DEMOGRAPHIC STATISTICS

4.1 Introduction

This chapter presents data cleaning and demographic statistics gathered in this research. Validation of measurement and structural models are discussed in the following two chapters.

The objective of this study is to investigate the impact of aligning global business information requirements and ERP systems capabilities on global business performance. First, this research establishes information requirements of global businesses. Next, it determines if ERP systems can meet global business information requirements. Finally, it examines the impact of aligning global business information requirements and ERP system capabilities on global business performance. Prior to conducting multivariate analysis with structural equation modelling technique, data were examined and cleaned to validate the soundness of the data and to minimize errors.

4.2 Data examination and cleaning

Data examination and cleaning are the very important initial steps if analysis is to be successful (Hair et al., 2010). It helps identify problems associated with raw data, understand the relationships between variables and provide an assurance that the data underlying the analysis meet the necessary requirements for multivariate analysis (Hair et al., 2010). Furthermore it assists researchers evaluate the impact of missing data, identify outliers and test important underlying assumptions including normality, homoscedasticity and linearity, measuring central tendency such as mean, median and mode and assessing reliability and response rate (Hair et al., 2010).

4.2.1 Analysis of missing data

Missing data due to errors in data collection or data entry or omission of answers by respondents is common in survey research (Hair et al., 2010). Existence of missing data has negative effects on data analysis (George and Mallery, 2011). These negative effects include misleading and bias results, loss of statistical efficiency, reduce the precision and statistical power of the data and unable to perform many of the data analysis procedures (Pearson, 2006). Therefore, dealing with missing data prior to analysis is important to ensure the legitimacy of data analysis (George and Mallery, 2011). A four-step process as recommended by Hair et al. (2010) was used to deal with missing data in this thesis. The first step is to determine the type of missing data, as either ignorable or non-ignorable and then it is necessary to determine the extent of missing data. In this stage, variables with 50% or more missing data are deleted. The next step is to diagnose the degree of randomness present in the missing data; missing at random or missing completely at random. The final step is to select an appropriate replacement method. These steps as applied to the data analysis in this research are discussed in the following section.

1) Step One: Determining the type of missing data

Here I investigated if the missing data is part of the research design (ignorable missing data) or the causes and impacts are unknown (non-ignorable missing data). There were both ignorable and non-ignorable missing data in the data set. Ignorable missing data arose due to the nature of the data collection instrument. The survey instrument used a 5-point Likert scale to collect responses but it included a not applicable option for each question to minimise the risk of obtaining inaccurate responses. There were 159 data points under the not applicable option accounting for less than 1% of total responses. These responses were ignored as missing data, which were inherent. These missing data were kept in the dataset and given a value of "0" to distinguish them from other responses.

At the same time, there were non-ignorable data present throughout the data set, which occurred due to errors in data entry and respondents' failure to complete the entire questionnaire. Data cleaning was performed separately for non-ignorable missing data.

2) Step Two: Determining the extent of missing data for individual variables, respondents and overall

Overall, there were 1,656 missing data points out of 16,709 data points (9.9%). The missing data for individual variables ranged from 8% to 12%. The missing data for individual respondents were range from 1% to 96%. There were 21 respondents with over 50% missing data. Of these 21 respondents, there were 5 respondents whose organisation did not operate globally and 5 did not have an ERP system. These 10 respondents did not qualify for inclusion in this research and consequently they were deleted from the data set. The percentage of missing data of the remaining 11 items were analysed in Table 4.1.

Table 4-1: Analysis of missing data

No	Respondent ID	Total No: of items	No: of missing items	% of missing items
1	1501444729	93	77	83%
2	1500491961	93	81	87%
3	1492854579	93	78	84%
4	1492839454	93	89	96%
5	1486261588	93	78	84%
6	1486236972	93	78	84%
7	1484329538	93	79	85%
8	1481929487	93	78	84%
9	1480671879	93	77	83%
10	1475273949	93	77	83%
11	1474088240	93	78	84%

Judging by the data in Table 4.1 it is evident that these 11 responses have 80% of missing data. They were deleted from the data set as recommended by Hair et al. (2010). Therefore, 196 responses were available to proceed to the next stage.

3) Step Three: Ascertaining degree of randomness present in the missing data

Missing at random refers to data missing on an observed variable (Y) which is dependent on other observed variable/variables but independent of the values of that variable (Y) itself (Holmes-Smith, 2011). There were 175 missing points in the remaining data set. This accounted for 1.2% (175/15,092). In order to diagnose the level of randomness in the missing data, overall test of randomness (Little's MCAR test) was carried out. Results revealed that the pattern of randomness is missing completely at random with a chi-square of 5719, DF of 5644 and significance level of 0.24 (greater than .05).

4) Step Four: Replace missing values

The remaining missing values were replaced using the mean value replacement method.

4.2.2 Outliers

Outliers are observations that are identifiable as being different from other observations and they have to be corrected before continuing with any further analysis (Hair et al., 2010; Holmes-Smith, 2011). In the data set for this research, there were three cases with outliers. They arose due to incorrect coding of “44” instead of “4”, “22” instead of “2” and “23” instead of “2”. Frequency distributions and box plots for these outliers are presented in Appendix C. These outliers were corrected before the data analysis took place. After correcting missing data and outliers, there were 196 usable responses could be used for quantitative analysis.

4.2.3 Reliability of data

Reliability of the data was accomplished using Cronbach’s alpha (α) for question items. Cronbach’s alpha helps to identify whether the items in the instrument measure the same thing (George and Mallery, 2011). The value of Cronbach’s alpha varies between 0 and 1 and the closer the value to 1, the greater the reliability of the items in the instrument (George and Mallery, 2011). This analysis is presented in Table 4.2.

Table 4-2 : Reliability (Cronbach's alpha) of the data

	Latent variable	Questions	No. of Questions	Cronbach's α value
Global Business Information Requirements	Multi-level information	17-21	5	0.73
	Multi- purpose information	22-26	5	0.77
	Accurate and timely information	27-30	4	0.69
	Consolidated information	31-35	5	0.80
	Global business process information	36-42	7	0.48
	Global supply chain information	43-47	5	0.70
	Information security	48-51	4	0.34
ERP systems capabilities	Support multi-level information	52-56	5	0.66
	Support multi-purpose information	57-61	5	0.69
	Deliver accurate timely information	62-65	4	0.79
	Deliver consolidated information	66-70	5	0.85
	Integrate global business process information	71-75	5	0.63
	Manage global supply chain information	76-78	3	0.90
	Transmit secure information	79	1	-
Global business performance	Financial perspective	80-82	3	0.78
	Customer's perspective	83-85	3	0.64
	Learning and growth perspective	86-88	3	0.76
	Internal and business perspective	89-93	5	0.77

From Table 4.2 it is clear that the Cronbach's alpha values for many variables are greater than or closer to 0.7. Secure information and global business process information has a low value of Cronbach alpha (0.34 and 0.48). However, at this stage all the items were retained for further analysis.

4.2.4 Test of normality

The fundamental assumption of multivariate analysis is that the data has to be normally distributed and if the variation from normality is sufficiently large, all resulting statistical tests will turn out to be invalid (Hair et al., 2010). Therefore, graphical analysis of normality and statistical tests of normality were used in this research to test the normality of data.

The results of the statistical tests for normality (Kurtosis, Skewness, Kolmogorov-Smirnov and Shapiro-Wilk) are presented in Appendix D.1. Appendix D.1 indicates that the Kurtosis of many variables is within the acceptable range of ± 2.0. Skewness of all variables is within an acceptable range. The majority of variables have positive kurtosis indicating that the distribution is more peaked than normal. The standard error of Skewness and Kurtosis are 0.174 and 0.346 respectively. This indicates greater stability or smaller sampling error. Furthermore, it is clear from the data in Appendix D.1 that the significant value of both Kolmogorov-Smirnov and Shapiro-Wilk tests is zero “0”. A zero significant value of Kolmogorov-Smirnov and Shapiro-Wilk indicates that all the items are not normally distributed (George and Mallery, 2011).

From the analysis discussed above it is clear that the data in this study are not normally distributed. If non-normality is detected in a data set, researchers need to consider applying an appropriate remedy to overcome this (Byrne, 2010; Hair et al., 2010). This research applies the bootstrapping technique to overcome the issue of non-normality and is described in the following section.

4.2.5 Bootstrapping

Bootstrapping is a remedial strategy for dealing with non-normality in a data set (Brown, 2006). It was used to handle the presence of multivariate non-normal data in this data set (Byrne, 2010). Bootstrapping procedure made it possible to create multiple subsamples from the original data set and the stability of parameter estimates to be assessed with a greater degree of accuracy (Byrne, 2010).

4.2.6 Measures of central tendency

Mean, Median and Mode were used to measure the major trends of data in this research (George and Mallery, 2011). The data in Appendix D.2 shows that the mean value of many items are distributed in the range of 3 to 4, while the medium and mode for all items are also distributed in the range of 3 to 4.

4.2.7 Non-response bias

The assessment of non-response bias determined the external validity of the data and generalised the findings for the population (Velcu, 2010). This was established using an independent samples t-test comparing the "early" respondents against "late" respondents (Armstrong and Overton, 1977; Beimborn et al., 2009; Velcu, 2010). T-test assumes that the late respondents are more likely to be similar to non-respondents and, if no significant differences exist between early and late respondents, the likelihood is strong that non-response bias does not exist (Kearns and Lederer, 2004; Beimborn et al., 2009; Velcu, 2010).

As recommended by Dhaliwal et al. (2011) the data set was split into two categories - "Early" and "Late". Early responses represent responses received in between first e-mail and first reminder and late responses are responses received after the first reminder (Velcu, 2010). There were 106 early responses and 90 late responses. Table 4.3 includes the results of the independent samples t-test.

Table 4-3: Independent samples t-test for non-response bias

Independent samples t-test for nonresponse bias							
Construct	T	DF	P (Sig.)	Mean			Std. error
				Early	Late	Dif.	dif.
Mean of global business information requirements	.144	194	.886	3.45	3.44	0.01	0.10
Mean of ERP systems capabilities	-.851	194	.396	3.43	3.52	(0.09)	0.10
Mean of global business performance	-.589	194	.557	3.46	3.51	(0.05)	0.09

Table 4.3 shows that there are no significant differences between early and late respondents at a 95% confidence interval for all three constructs in the model. There is no significant difference between the means for the two groups (i.e. early vs. late). These results indicate that the time had no apparent influence on the perceptions of respondents and the data set is free of non-response bias.

4.2.8 Common method bias

The presence of common method bias can be determined using several methods including multiple respondents (Coltman et al., 2011; Lu and Ramamurthy, 2011), Harmon's single-factor test and Lindell and Whitney's market variable technique (Bhattacherjee, 2012). In this research, two approaches were used to examine the existence of common method bias. First, multiple respondents (marketing, human resources, production, accounting and finance, procurement, research and development, and operation and IT) were used to collect data. Second, Harman's post hoc one factor analysis was employed to examine common method bias in the data set (Podsakoff et al., 2003). This method suggests examining exploratory factor analysis (EFA) to determine the number of dominant factors in the data set (Coltman et al., 2011). If this analysis indicates:

1) One factor account for the majority (greater than 50%) of the covariance between measures

2) Factor analysis generates only a single factor

Then it can be concluded that common method bias exists (Podsakoff et al., 2003). Table 4.4 presents the results of EFA using the un-rotated principle component analysis.

Table 4-4: Test for common method bias (Harman's post hoc one factor analysis)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.87	24.83	24.83	18.87	24.83	24.83
2	7.56	9.94	34.78	7.56	9.94	34.78
3	2.69	3.54	38.32	2.69	3.54	38.32
4	2.05	2.70	41.02	2.05	2.70	41.02
5	1.86	2.45	43.47	1.86	2.45	43.47
6	1.63	2.14	45.61	1.63	2.14	45.61
7	1.60	2.11	47.72	1.60	2.11	47.72
8	1.54	2.02	49.74	1.54	2.02	49.74
9	1.39	1.82	51.57	1.39	1.82	51.57
10	1.36	1.79	53.36	1.36	1.79	53.36
11	1.33	1.74	55.10	1.33	1.74	55.10
12	1.30	1.70	56.81	1.30	1.70	56.81
13	1.17	1.54	58.35	1.17	1.54	58.35
14	1.16	1.53	59.88	1.16	1.53	59.88
15	1.13	1.49	61.37	1.13	1.49	61.37
16	1.05	1.39	62.75	1.05	1.39	62.75
17	1.05	1.38	64.13	1.05	1.38	64.13
18	1.03	1.35	65.48	1.03	1.35	65.48
19	0.99	1.30	66.78	0.99	1.30	66.78
20	0.98	1.29	68.07	0.98	1.29	68.07
21	0.95	1.24	69.32	0.95	1.24	69.32
22	0.93	1.22	70.54	0.93	1.22	70.54

Table 4.4 shows that the EFA generated 18 factors with eigenvalue greater than 1. These items account for approximately 65% of the total variance. The dominant factor (number 1) explains only 25% of the variance in the measures, which is less than 50% of the

covariance. These results indicate that the common method bias does not seem to be a major issue in this research.

4.3 Demographic statistics

This section discusses the demographic attributes of the responding organisations. It classified respondents by region, industry composition, geographical distribution, organisation size, number of countries these organisations are operating in, number of global strategic business units (GSBU) they have, globalisation history, IT systems in addition to ERP systems used, and managerial positions held by respondents. These assist in understanding the background information of the businesses that responded to the survey.

4.3.1 Responses by region

Responses to this survey were received from 5 different geographical regions. This data is presented in Table 4.5.

Table 4-5: Survey response by region

Classification by region			
Region	**Frequency**	**Percent**	**Cumulative Percent**
Asia pacific	160	82%	82%
Europe	19	10%	91%
USA	12	6%	97%
Africa	4	2%	99%
Latin America	1	1%	100%
Total	196	100%	

Table 4.5 shows that the majority (82%) of organisations taking part in this survey were from the Asia-Pacific region, confirming that many businesses now have an Asian focus

(Bharadwaj et al., 2010). Responses were also received from Europe (10%), the USA (6%), Africa (2%) and Latin America (1%). This indicates that organisations in other regions (Europe and the USA) are also expanding globally.

4.3.2 Industry composition

Table 4.6 summarises the industry classification of responding organisations. The industry classification is based on the Australian and New Zealand industry classification (ANZSIC) system (Trewin and Pink, 2006).

Table 4-6: Survey response by industry sector

Industry composition			
Industry sector	**Frequency**	**Percent**	**Cumulative Percent**
Manufacturing & trading	100	51%	51%
Agriculture, forestry & fishing	24	12%	63%
Services	15	8%	71%
Gas and Electricity	13	7%	78%
Communications	12	6%	84%
Finance and insurance	10	5%	89%
Construction	7	4%	92%
Mining	6	3%	95%
Multiple industries	2	1%	96%
Transportation	2	1%	97%
Tourism	1	1%	98%
Research & development	1	1%	98%
ICT	1	1%	99%
Missing	2	1%	100%
Total	196	100%	

Data presented in Table 4.6 indicates that approximately 51% of participating organisations are in manufacturing and trading and operating globally. This is consistent with the ratio of participants in Arnold et al. (2010) on global supply chains, in which 47% of participating organisations were manufacturing and trading concerns. Other industries participated in the survey included agriculture, forestry and fishing (12%), services (8%), gas and electricity (7%), communications (6%) and finance and insurance (5%). These results indicate that organisations in most industries operate on a global basis.

4.3.3 Geographical distribution

The responding organisations were located in 45 countries. The list of countries where they are operating is presented in Appendix E. The main countries included India (10.2%), Sri Lanka (9.7%), Malaysia (8.55%), Indonesia (6.74%), Singapore (6.41%) and China (5.43%). Even though China is considered to be the hub for global organisations in Asia (Yadong Luo, 2001), these results indicate that other countries such as India, Sri Lanka, Malaysia and Indonesia are increasingly adopting global trade (Friedman, 2006; Mathews, 2009). It is evident that responding organisations were operating in two or more countries. Table 4.7 indicates the number of countries in which the responding organisations have global business operations.

Table 4-7: Survey response by number of countries

Number of countries for global operations			
No of countries	**Frequency**	**Percent**	**Cumulative Percent**
2-5	53	27%	27%
6-10	39	20%	47%
11-15	25	13%	60%
16-20	26	13%	73%
21-25	31	16%	89%
>25	22	11%	100%
Total	196	100%	

Data presented in Table 4.7 indicates that the organisations responding to this survey were truly global with the number of countries they operated in ranging from 2 to more than 25. 11% of these businesses had global operations in more than 25 countries. 16% of them were operating in 21-25 countries, 13% were doing business in 16-20 countries, 13% had business operations in 11-15 countries, 20% of them were operating between 6-10 countries and the remaining 27% had global business operations in 2-5 countries. Overall, most companies (53%) functioned in over 11 countries and 7 indicated that they do business in more than 200 countries. These findings confirmed that global organisations operate simultaneously in many different countries.

4.3.4 Organisation size

The size of the organisation was determined based on the turnover and number of employees (Chan et al., 2006). Classification of large, medium and small organisations was used to classify the responding organisations based on Pita's (2007) classification. Annual turnover exceeding 500Mn AUD or having more than 500 employees were classified as large organisations, annual turnover between 10Mn - 500Mn AUD or number of employees between 100 and 500 were classified as medium organisations and annual turnover less than 10Mn AUD or number of employees less than 100 were classified as small organisations. Classification of global organisations based on size (turnover and number of employees) is presented in the following section.

4.3.4.1 Size of organisations classified by annual turnover

Classification of the responding organisations based on annual turnover is presented in Table 4.8.

Table 4-8: Survey response by annual turnover

Annual turnover				
Turnover	**Category**	**Frequency**	**Percent**	**Cumulative Percent**
< 1Mn	**Small**	1	1%	1%
1-9Mn		7	4%	4%
10-99Mn	**Medium**	27	14%	18%
100-199Mn		37	19%	37%
200-499Mn		26	13%	50%
500-999Mn	**Large**	51	26%	76%
> 1000Mn		47	24%	100%
Total		**196**	**100%**	

Approximately 95% of the organisations had an annual turnover exceeding 10 Mn AUD, meaning that most organisations are large (50%) and medium (46%) sized organisations. All responding companies used ERP systems to manage their information requirements and operated in two or more countries. This confirms that generally large and medium scale organisations use ERP systems to manage global information requirements (Chand et al., 2005). Morris and Venkatesh (2010) also indicate that ERP adoption among large and medium manufacturing companies is around 75%. Only 4% of the responding organisations were small ones. This finding indicates that ERP systems are employed by large global organisations to support complex business operations confirming Morton and Hu, (2008) and Kien and Lian, (2009) opinions.

4.3.4.2 Classification of survey respondents by number of employees

Table 4.9 shows the size of responding organisations based on number of employees in the group.

Table 4-9: Survey response by number of employees

No of employees				
No of employees	**Category**	**Frequency**	**Percent**	**Cumulative Percent**
0-100	**Small**	2	1%	1%
101-200	**Medium**	13	7%	8%
201-500		38	19%	27%
501-1000	**Large**	36	18%	45%
1001-5000		37	19%	64%
5001-9999		36	18%	83%
> 10000		34	17%	100%
Total		**196**	**100%**	

Data in Table 4.9 indicates that regarding number of employees 73% of the responding organisations were large, 26% were medium and only 1% were small. Overall, 99% of the respondents were from large and medium-sized global organisations, meaning that they use ERP systems to manage their global business operations.

4.3.5 Number of global strategic business units (GSBUs)

Characteristically, global organisations have a number of global SBUs that carry out different business functions (Kumar et al., 2008). The breakdown of the number of GSBUs from the responding organisations is presented in Table 4.10.

Table 4-10: Survey response by number of GSBUs

No	Frequency	Percent	Cumulative Percent
2-5	20	10%	10%
6-10	38	19%	30%
11-15	43	22%	52%
16-20	56	29%	80%
21-25	15	8%	88%
>25	23	12%	99%
Missing	1	1%	100%
Total	196	100%	

As shown in Table 4.10, 10% of the responding organisations had 2-5 SBUs, 19% of them had 6-10 SBUs, 22% had 11-15 SBUs, 29% had 16-20 SBUs and 20% had over 21 SBUs. These results indicate that most of the responding organisations were truly global (71%) with more than 11 global strategic business units.

4.3.6 Globalisation history

Globalisation history is represented by the number of years (age) the organisation has done business on a global basis (Kim and Oh, 2000). Table 4.11 provides the breakdown of globalisation history of the responding organisations.

Table 4-11: Survey response by globalisation history

No of years	Frequency	Percent	Cumulative Percent
0-5	16	8%	8%
6-10	19	10%	18%
11-15	31	16%	34%
16-20	51	26%	60%
21-25	28	14%	74%
>25	50	26%	99%
Missing	1	1%	100%
Total	196	100%	

More than 80% of organisations that responded to the survey had a globalisation history of 11 years or more. Only 8% of respondents had less than 5 years of global experience. 10% of these firms had 6-10 years of global experience, 16% had 11-15 years of global experience, 26% had 16-20 years of global experience, 14% had 21-25 years and 26% of them had over 25 years of global experience. The figures also show that the global business trend is growing with 18% having started global operations in the last ten years.

4.3.7 Other systems in addition to ERP systems used to support global business operations

The data in Table 4.12 indicates that although ERP systems support global organisations, a number of other systems are also used for managing their operations.

Table 4-12: Other systems used to support global operations

Other information systems used to manage global business operations			
Name	**Frequency**	**Percent**	**Cumulative Percent**
Microsoft Excel	65	36%	36%
Accpacc	27	15%	50%
In house systems	25	14%	64%
AS400	17	9%	73%
Sage	10	5%	79%
Coda	8	4%	83%
MYOB	7	4%	87%
Others	24	13%	100%
Total	183	100%	

A number of other systems such as Microsoft Excel (36%), Accpacc (15%), In House Systems (14%), AS 400 (9%), Sage (5%), Code (4%) and MYOB (4%) are used by many organisations to support their global business operations. This finding indicates that although ERP systems are the predominant IT systems used for global business management, some specific applications are managed by other IT systems.

4.3.8 Managerial positions held by respondents

The survey was sent to 700 managers in global organisations. Table 4.13 shows the positions of the respondents participated in the survey.

Table 4-13: Survey response by position

Position	Frequency	Percent	Cumulative Percent
Senior Manager	69	35%	35%
CIO	33	17%	52%
General Manager	32	16%	68%
Department Manager	24	12%	81%
Junior Manager	23	12%	92%
CEO	9	5%	97%
Director	2	1%	98%
Vice president	1	0.5%	98%
Chairman	1	0.5%	99%
Missing	2	1%	100%
Total	196	100%	

Data presented in Table 4.13 indicates that most respondents were senior managers (35%), CIOs (17%), general managers (16%), department managers (12%), junior managers (12%) and CEOs (5%).

4.4 Summary

This chapter discussed the data cleaning and demographic statistics of this research. It explained the missing data, outliers, normality, central tendency (mean, median and mode), reliability of the data, non-response bias and common method bias. Then, it discussed demographic statistics of the participating organisations including responses according to region, industry composition, geographical distribution, organisation size, globalisation history, other systems for managing global operations and managerial positions. The next chapter confirms global business information requirements, ERP systems capabilities required for global business management and global business performance outcomes before testing the research model.

CHAPTER 5. MEASUREMENT MODEL VALIDATION

5.1 Introduction

This chapter discusses the measurement model development from an analysis of data collected from the online survey. This research uses structural equation modelling (SEM) to validate the measurement model. The chapter begins with a discussion of selecting an appropriate statistical technique for multivariate data analysis. Next, exploratory factor analysis (EFA) was conducted. Then, one-factor congeneric measurement models of all the variables were developed and validated. Next, measurement models of the three main constructs, global business information requirements (GBIR), ERP systems capabilities (ERPSC) and global business performance (GBPER) are discussed. This chapter concludes with a discussion of the full confirmatory factor analysis (CFA) measurement model and a summary of the major themes covered.

5.1.1 Selecting an appropriate statistical technique

Selecting an appropriate statistical technique for analysing data is an essential requirement that should be planned from the early stage of the research process (Bryman and Bell, 2011). It provides a structured approach and the basis for evaluating data (Wetcher-Hendricks, 2011). Hair et al. (2010) argued that in determining appropriate statistical technique to be used, it is important to pay attention to the following characteristics of variables:

1) Can variables be divided into independent and dependent classification based on some theory?

2) If they can, how many variables are treated as independent and how many are dependent?

3) How are these variables, both dependent and independent, measured?

The research model proposed in this study has 14 independent variables, three intervening variables, two moderator variables and one dependent variable with four sub elements. This model involves testing of multiple relationships of dependent and independent variables. SEM is highly recommended when researchers want to explore the multiple relationships of dependent and independent variables (Hair et al., 2010).

It is also argued that the multivariate responses reflect true responses more accurately than a single response (Hair et al., 2010). Employing multivariate measures such as SEM makes it possible to merge several variables into a composite measure to represent a concept (Hair et al., 2010). Furthermore, the SEM technique is more user-friendly in that it can analyse models that are more advanced and provides high level of reliability and validity (Schumacker and Lomax, 2004). This helps obtain a well-rounded perspective by joining several variables together (Hair et al., 2010). Statistical software IBM SPSS AMOS version 19 was used to carry out SEM analysis.

5.2 Structural equation modelling (SEM)

SEM is a multivariate technique that combines aspects of factor analysis and multiple regressions to examine simultaneously a series of interrelated dependent relationships among: firstly, the measured variables and latent constructs; and secondly, between several latent constructs (Byrne, 2010; Hair et al., 2010). It takes a confirmatory approach (hypothesis testing) to the analysis of a structural theory concerning a phenomenon

(Byrne, 2010). SEM has become a popular analysis technique for social science research due to the features offered by SEM compared to traditional multivariate procedures (Byrne, 2010). These features are useful for assessing or correcting measurement errors, with the ability to incorporate both unobserved and observed variables to model multivariate relationship and take a confirmatory rather than an exploratory approach to data analysis. This makes hypotheses testing more convenient (Byrne, 2010). Therefore, SEM can be used to statistically test a hypothesized model, and it can simultaneously analyse all variables to determine the extent to which the hypothesized model is consistent with data (Byrne, 2010). Furthermore, SEM addresses two important aspects of the procedure (Byrne, 2010):

1) Determine causal processes under study that are represented by a series of structural equations

2) Structural relationship can be modelled pictorially so that a clearer conceptualisation emerges.

5.2.1 Approach to SEM

Anderson and Gerbing (1988) proposed a comprehensive two-step modelling approach for SEM. It involves building and analysing two conceptually distinct models: a measurement model and a structural model (Byrne, 2010; Hair et al., 2010; Schumacker and Lomax, 2010).

1) Measurement model

   Measurement model specifies the relationships among measured (observed) variables underlying the latent variables. It represents the dependence relationship between measured variables and constructs or how measured variables come together to represents constructs. It analyses the relationship between latent construct and their associated items. In the measurement model, arrows typically draw from latent constructs to the variables that are associated with the constructs (indicators).

2) Structural model

The structural model specifies relationship among the latent variables as postulated by theory. It represents how constructs are associated with each other.

This research used the six-stage process developed by Hair et al. (2010) to validate measurement and structural models and this is presented in Figure 5.1.

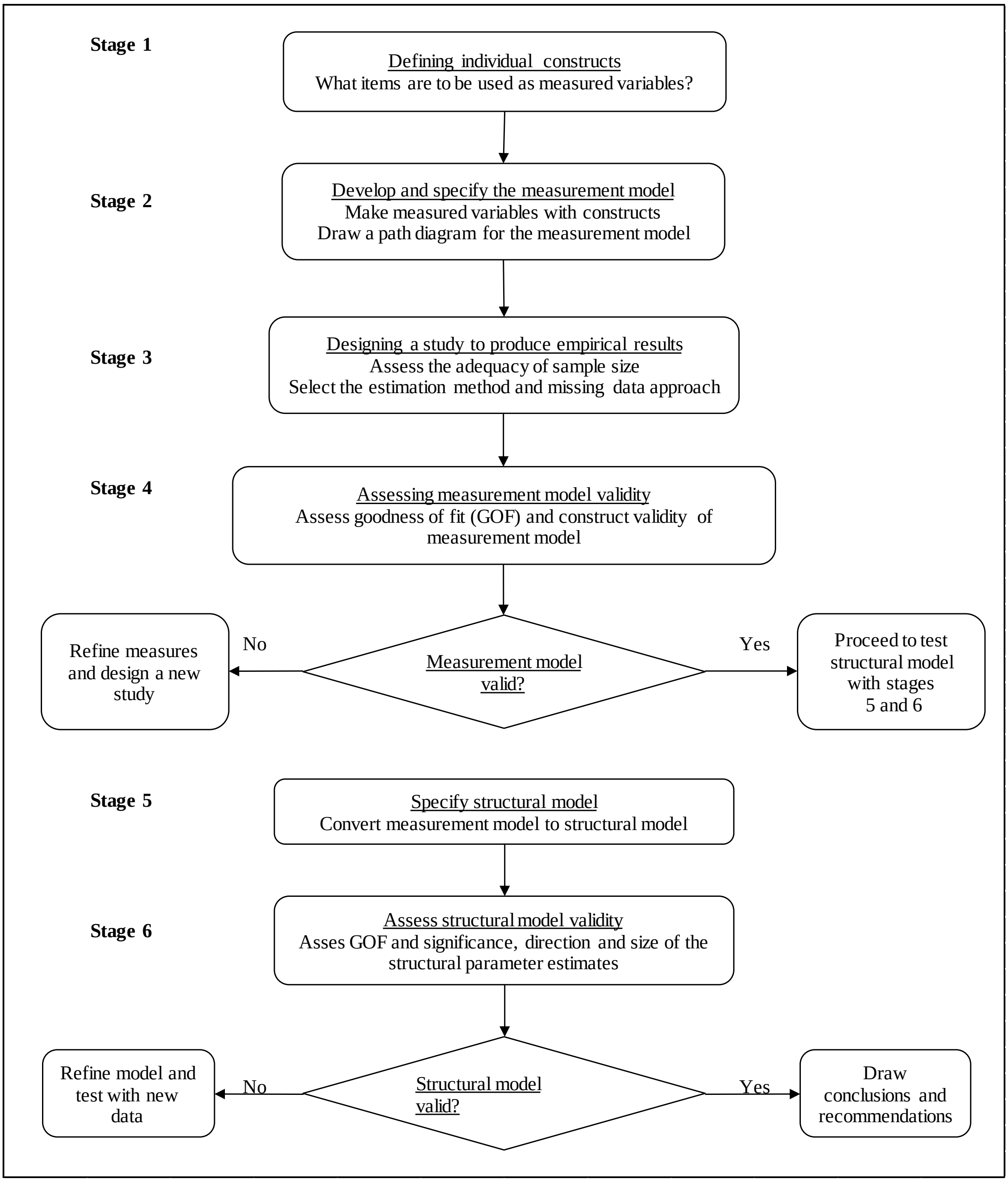


Figure 5-1 : Six-stage process of validating measurement and structural model

This chapter covers stages 1 to 4 as shown in Figure 5.1. The next chapter discusses stages 5 and 6, which are concerned with the development of the structural model.

5.2.2 Factor analysis

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are statistical procedures for investigating the relationship between sets of observed and latent variables (Byrne, 2010). EFA is used in situations where the links between observed and latent variables are unknown or uncertain and CFA is used in situations where researchers have some knowledge about the underlying latent variable structure (Byrne, 2010). Therefore, in CFA researchers hypothesize the relationship between observed and latent variables based on knowledge of prior theory, empirical research in the area of study, or both, and finally test hypothesised structure statistically (Byrne, 2010).

5.2.3 Exploratory factor analysis (EFA)

The initial research model in this research is derived from existing literature and guided by theories of IT/IS alignment for improved performance. EFA was conducted to identify the underlying structure proposed by EFA. Prior to conducting EFA, the main assumptions of factor analysis were evaluated. They include testing of normality, which was tested during data cleaning and demographic statistics, and testing of intercorrelations of the entire correlation matrix, which has been examined using Kaiser-Meyer Oklin (KMO) test and Bartlett's Test of Sphericity (Hair et al., 2010). The results of these tests are presented in Table 5.1.

Table 5-1: Kaiser- Meyer Oklin (KMO) test and Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling		.929
Bartlett's Test of Sphericity	Approx. Chi-Square	10387
	df	2926
	Sig.	.000

The KMO test measures the sampling adequacy and has to be greater than 0.5 for factor analysis to proceed (Hair et al., 2010). The Bartlett's Test of Sphericity below a significance level of 0.05 indicates that the items have sufficient correlations (Hair et al., 2010). In this case, both test results fall within the acceptable range indicating that the assumptions of intercorrelations are met. EFA was conducted separately for three main constructs, global business information requirements, ERP system capabilities and global business performance. The results of the EFA are presented in Appendices F.1, F.2 and F.3.

EFA is suitable when research does not have a priori specified theoretical model (Byrne, 2010; Schumacker and Lomax, 2010). In situations where research has a priori specified theoretical model, factor analysis needs to take a confirmatory approach (CFA) (Brown, 2006; Byrne, 2010; Schumacker and Lomax, 2010). Therefore, unlike the approach in EFA, in which the researcher can only specify the number of factors, in the CFA, a researcher can test for a much more parsimonious solution by indicating the number of factors, the pattern of factor loadings and an appropriate error theory (Brown, 2006).

As mentioned earlier, this research is based on extant theory on ERP systems, global business, business performance and IT/IS alignment; therefore CFA is more appropriate (Brown, 2006; Byrne, 2010; Schumacker and Lomax, 2010). Furthermore, Venkatraman, (1989) argued that when relative benefits of both EFA and CFA are weighted, the CFA approach is the most appropriate approach for modelling fit as co-alignment. CFA also offers greater modelling flexibility and a stronger analytic framework than EFA (Brown, 2006). Consequently, this research used CFA to establish the proposed research model. The next section discusses the confirmatory factor analysis in detail.

5.2.4 Confirmatory factor analysis (CFA)

The three main constructs of global business information requirements, ERP system capabilities and global business performance have been assessed separately to ascertain their construct validity. First, CFA was performed for global business information requirements construct, ERP system capabilities and global business performance. Next full CFA measurement model was developed and validated.

5.2.5 Goodness of fit (GOF) statistics

Achieving acceptable level of goodness of fit (GOF) is an important element for determining model validity (Hair et al., 2010). GOF statistics "indicate how well a specified model reproduces the observed covariance matrix among the indicator items" (Hair et al., 2010, p. 646). If observed and estimated covariance matrices turn out to be the same then it can be concluded that the selected theory is perfect and when the GOF statistics results are closer to the accepted values, the better the model fit (Hair et al., 2010).

GOF statistics are categorized into three major groups: absolute fit measures, incremental fit measures and parsimony fit measures (Hair et al., 2010). Absolute fit measures are independent direct measures of how well the model specified by the researcher reproduces the observed data. They assess how well the researcher's theory fits with the sample data. On the other hand incremental fit indices measure how well the estimated model fits relative to some alternative baseline models. The most common baseline model is a null model that assumes all observed variables are uncorrelated. The third group of GOF statistics is the parsimony fit measures, in which the focus is on providing information to select the best model from a set of competing models. These fit measures are not very useful in assessing the fit of a single model, but are important in assessing the fit of more complex models (Hair et al., 2010). Recommended GOF measures are presented in Table 5.2.

Table 5-2: Summary of GOF measures

Category	**GOF Statistic**	**Recommended value**	**Reference**
Absolute fit measures	P - Value (X^2)	> 0.05	Hair et al., (2010); Holmes-Smith, (2011)
	CMIN/DF (X^2/DF)	Between 1 & 2	Hair et al., (2010); Holmes-Smith, (2011)
	RMSEA	< 0.08 (with CFI above 0.92)	Hair et al., (2010)
	SRMR	< 0.09 (with CFI above .92)	Hair et al., (2010)
Incremental fit measures	CFI	> 0.92	Hair et al., (2010)
	TLI	> 0.9 or 0.92	Hair et al., (2010); Schumacker and Lomax, 2010
	RFI	> 0.92	Hair et al., (2010)
Parsimony fit measures	AGFI	Close 0.90 or 0.95	Schumacker and Lomax (2004); Hair et al., (2010); Schumacker and Lomax, 2010
	PCLOSE	> 0.05	Hair et al., (2010); Holmes-Smith, (2011)
N< 250 and M ≥ 30 (N = number of observations, M= number of observed variables			

5.3 Initial assessment of the full measurement model

The initial full measurement model of this study is depicted in Appendix H.1.

As shown in Appendix H.1, the initial full measurement model consists of three constructs, namely global business information requirements, ERP systems capabilities and global business performance. Global business information requirements construct consists of seven variables: multi-level information (MLIN), multi-purpose information (MPIN), accurate and timely information (ATIN), consolidated information (CIN), global business process information (GBPIN), global supply chain information (GSCIN) and secure information (SIN). Similarly, ERP systems capabilities construct contains seven variables, these being: support multi-level information (SMLIN), support multi-purpose information (SMPIN), deliver accurate and timely information (DATIN), deliver consolidated information (DCIN), integrate global business process information (IGBPIN), manage global supply chain information (MGSCIN) and transmit secure information (TSIN). Finally, the global business performance constructs consists of four variables: financial performance (FINP), customer performance (CUSP), learning and growth performance (LGP) and internal business process performance (IBPP).

5.4 Measurement model for GBIR construct

As discussed in the literature review chapter, global businesses information requirement (GBIR) construct consists of seven variables namely multi-level information (MLIN), multi-purpose information (MPIN), accurate and timely information (ATIN), consolidated information (CIN), global business process information (GBPIN), global supply chain information (GSCIN) and secure information (SIN). The initial measurement model of global business information requirements along with its GOF statistics are presented in Figure 5.2 and Table 5.3.

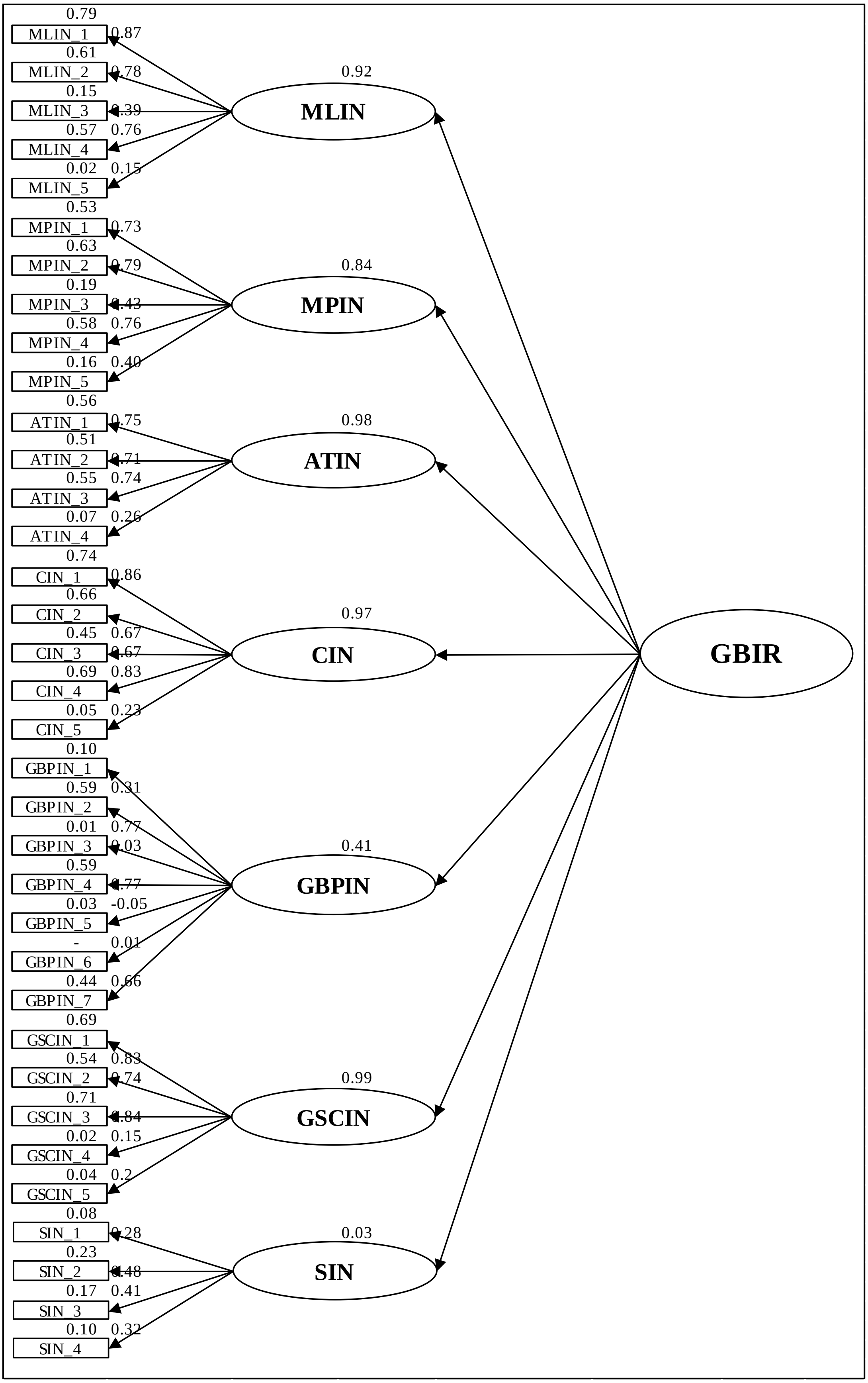


Figure 5-2 : Initial measurement model of global business information requirements

As shown in Figure 5.2 the initial measurement model for global business information requirements is modelled as a reflective second order construct derived from seven first order reflective variables. Reflective construct assumes that covariation among the measures is caused by, and therefore reflects, variation in the underlying latent factor (Jarvis et al., 2003; Hair et al., 2010). Thus, the arrows in reflective constructs are drawn from the latent construct to the measured variables (Hair et al., 2010). GBIR construct has been drawn as a reflective second order construct since it assumes that the global business information requirements are reflected (manifested) by seven variables namely MLIN, MPIN, ATIN, CIN, GBPIN, GSCIN and SIN (Jarvis et al., 2003; Diamantopoulos and Siguaw, 2006). The indicators of this model are also interchangeable and share a common theme, which is to support global business operations, these being the key determining factors of reflective constructs (Jarvis et al., 2003). Indicators are considered as functions of the latent variables (Diamantopoulos and Siguaw, 2006). Therefore, dropping an indicator may not alter the conceptual domain of the construct (Jarvis et al., 2003). Furthermore, this model measures its error terms at the item level as recommended by Jarvis et al. (2003) and Bollen (2011).

Table 5-3: GOF statistics of global business information requirements construct

Model identification		**GOF statistics**			
No. of observed variables	35	Bootstrap p	0.01	CFI	0.881
No. of estimated parameters	127	X^2	899.86	TLI	0.872
DF	553	(X^2/DF)	1.627	RFI	0.724
Model is identified		RMSEA	0.057	AGFI	0.744
		SRMR	0.083	PCLOSE	0.052

The initial measurement model of global business information requirements has been identified with a chi-square of 899, 553 DF and a p value of 0.01. However, this model does not fit as most of the GOF statistics are not within the accepted ranges. P-value

(0.01), CFI (0.88), TLI (0.87), RFI (0.72) and AGFI (0.74) are well below the recommended values of 0.05, 0.92, 0.92, 0.92 and 0.95 respectively. Furthermore, some of the items and variables have very low SRW and SMC. For example items such as MLIN_5 (0.15/0.02), ATIN_4 (0.26/0.07) CIN_5 (0.23/0.05) and GSCIN_5 (0.2/0.04) have very low SRW and SMC. Furthermore, variable SIN (0.03) has very low SMC. These results indicate that the full measurement model of global business information requirements cannot be accepted and need to be re-examined (Holmes-Smith, 2011). Model re-examination has been carried out by examining the GOF statistics, reliability and validity of one-factor congeneric models (Hair et al., 2010). The development and validation of one factor congeneric measurement models regarding global business information requirements construct are presented in the next section.

5.4.1 One factor congeneric measurement model of MLIN

One factor congeneric measurement model is the simplest form of a measurement model that represents the regression of the observed variables and single latent variable (Holmes-Smith, 2011). One factor congeneric measurement model of multi-level information (MLIN) has five observed variables namely, MLIN_1 (information requirements at the head office level), MLIN_2 (information requirements from SUBs), MLIN_3 (information requirements at the senior management level), MLIN_4 (information requirements at the middle management) and MLIN_5 (information requirements at the non-managerial levels). The initial path diagram of the multi-level information (MLIN) variable is shown in Figure 5.3.

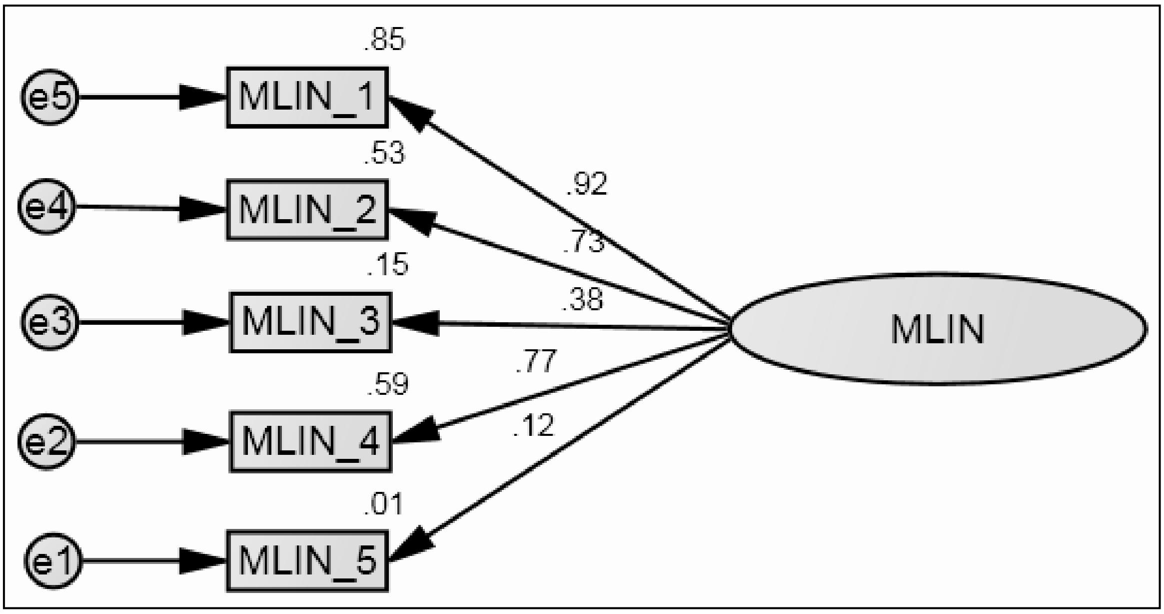


Figure 5-3 : Initial path diagram of the MLIN congeneric measurement model.

In the above figure, the standardised regression weight (SRW) and squared multiple correlations (SMC) are shown above the arrow and above the items respectively. Indicator variables are associated with measurement errors (e-1 to e5) to identify the associated measurement errors and to provide more accurate estimates of the relationships between items and the variable (Hair et al., 2010). From the above it is apparent that SRW and SMC of MLIN_3 and MLIN_5 are very low compared to the acceptable ranges of 0.5 and 0.3 and with other items in the model. However, further statistical measures are required to determine their validity. Table 5.4 presents selected statistical results of the MLIN congeneric measurement model.

Table 5-4 : GOF statistics of MLIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.144	CFI	0.977
No. of estimated parameters	16	X^2	11.729	TLI	0.954
DF	5	(X^2/DF)	2.346	RFI	0.922
Model is identified		RMSEA	0.083	AGFI	0.930
		SRMR	0.049	PCLOSE	0.156

The above statistical results indicate that the congeneric measurement model of MLIN is identified with five degrees of freedom (DF). SRMR (0.049), CFI (0.977), TLI (0.954), RFI (0.922) and PCLOSE (0.156) of the model are within the acceptable ranges. However, normed chi-square value (X2/DF) (2.346) is higher than the recommended value of 1< (X2/DF) < 2. RMSEA (0.083) value is also slightly higher than the recommended value of .08. Even though some GOF statistics are within the acceptable ranges, the statistical results (weak normed chi-square and RMSEA) reveal that the model does not have an acceptable fit. Therefore, this model has to be re-specified.

5.4.1.1 Model re-specification

According to Hair et al. (2010) and Holmes-Smith (2011), model re-specification can be done using several diagnostic measures. These measures include critical ratio (t-value), minimum number of items in a variable, standardised factor loading (SFL)/standardised regression weight (SRW), standardised residual covariances (SRC) and modification indices (MI).

5.4.1.2 Critical ratio (t-value)

Examination of statistical significance levels (critical ratio) of estimated parameters in the model is an important starting point when re-specifying models (Holmes-Smith, 2011). The critical ratio can be estimated by dividing parameter estimate by its standard error (estimate/ standard error of the estimate). For a model to be fit, all parameter estimates should be in the expected direction and significantly different from zero (that is, the critical ratio should be larger than ±1.96 at the $\alpha = 0.05$ significance level) (Holmes-Smith, 2011).

5.4.1.3 Minimum number of items in a variable

Deciding the number of items in a variable is a dilemma faced by many researchers (Hair et al., 2010). Researchers prefer to have many items in a variable to fully represents the construct and maximise reliability. On the other hand, parsimony requires a variable to have fewer items (Hair et al., 2010). However, more items in a variable are not necessarily better as it requires a larger sample size and makes it difficult to produce truly unidimensional variables (Hair et al., 2010). Therefore, it is recommended to have a minimum of three items, preferably four in a variable (Dawn, 2010; Hair et al., 2010). Therefore, this research included a minimum of three items for each variable.

5.4.1.4 Standardised factor loading (SFL)

Standardised factor loading (regression weight) explains the correlation between item and variable (Hair et al., 2010). The larger the regression weight, then the higher the significance of that factor in the variable. Factor loading in the range of ± 0.30 to ± 0.40 are considered to have a minimum level of significance, loadings ± 0.50 or greater are considered practically significant and loadings exceeding 0.70 are considered well-defined (Hair et al., 2010). For a sample of 200, a factor loading 0.40 and above are considered acceptable (Hair et al., 2010). The squared multiple correlation (SMC) is the square of the SFL (Holmes-Smith, 2011). SMC is equivalent to item reliability (Holmes-Smith, 2011) and measures the amount of the variable's total variance accounted for by the item (Hair et al., 2010). For example, 0.7 SFL translates to approximately 0.5 SMC (Hair et al., 2010). In this research, thresholds of SFL and SMC values were set as 0.5 and 0.3.

5.4.1.5 Standardised residual covariances (SRC)

Residuals are the individual differences between observed covariance terms and estimated covariance terms (Hair et al., 2010). The residual covariances identify the difference between the sample covariance matrix and the model predicted covariance matrix (Holmes-Smith, 2011). Examining the residual covariances is the soundest method of identifying the source of model misspecification and a large residual covariance between two variables indicate that the association between these variables is not accounted for adequately by the model (Holmes-Smith, 2011). The standardised residuals are calculated by dividing raw residuals by the standard error of the residual (Hair et al., 2010) and should be in the range of ±1.96 (at the $\alpha = 0.05$ significance level) for a model to be fit (Holmes-Smith, 2011). The smaller the standardised residuals, better the model fit (Hair et al., 2010). The standardised residuals less than 2.5 do not suggest problems but value greater than 4.0 are unacceptable (Hair et al., 2010). In this research, SRC values in the range of ±1.96 were accepted.

5.4.1.6 Modification indices (MI)

Another method for identifying the source of model misspecification is the modification indices (MI). The modification indices calculate possible relationships that are not estimated in the model (Hair et al., 2010). It represents the decrease in the value of chi-square that would result if the parameter could be estimated in the revised model (Holmes-Smith, 2011). A value of MI 4.0 or greater suggests that the model fit can be improved by freeing the corresponding path that is to be estimated (Hair et al., 2010). Therefore, in this research parameters with largest MI are used for model re-specification, taking into account the theoretical rationale behind the proposed estimation.

5.4.1.7 Re-specification of one factor MLIN congeneric measurement model

In order to understand the cause of the model misfit the above discussed diagnostic measures, critical ratio, minimum number of items, SFL, SRC and MI, were examined. The results of these diagnostic measures are presented in Table 5.5.

Table 5-5: Model re-specification diagnostic measures of MLIN variable

Standardized Residual Covariances (SRC)						Modification indices				
Item	MLIN_1	MLIN_2	MLIN_3	MLIN_4	MLIN_5				M.I.	Par Change
MLIN_1	0					e1	<-->	e3	6.845	0.104
MLIN_2	0.07	0								
MLIN_3	-0.349	0.275	0							
MLIN_4	0.027	-0.328	0.822	0						
MLIN_5	-0.236	0.331	**2.375**	-0.045	0					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
MLIN_1	<---	MLIN	0.924	0.854	1.586	***				
MLIN_2	<---	MLIN	0.730	0.532	1.590	***				
MLIN_3	<---	MLIN	0.381	0.145	1.547	***	SMC & CR are low			
MLIN_4	<---	MLIN	0.767	0.588	1.592	***				
MLIN_5	<---	MLIN	0.121	0.015	-	0.006	SRW, SMC & CR are low			
DF: Degree of freedom										
SRW: Standardised regression weight										
CR: Critical ratio										
SMC: Squared multiple correlations										

Note: *** p< 0. 001 (two -tailed)

As shown in Table 5.5, the critical ratios of all the items are outside the acceptable threshold of ± 1.96. SRC between MLIN_5 and MLIN_3 (2.375) is greater than the acceptable range of ±1.96. SRW and SMC of MLIN_5 (.121/0.015) are also very low. Furthermore, SMC of MLIN_3 (0.145) and MLIN_5 (0.015) is very low compared to the recommended threshold of 0.3 and with SMC values of other items in the model. These results indicate that the association between these two items has not been accounted for sufficiently by the model and can constitute the cause for model misfit (Hair et al., 2010; Holmes-Smith, 2011). Therefore, these items were re-specified. The modification indices indicate that if e1 and e3 were covaried, the chi-square would be improved by 6.8. The par change of this modification is 0.10, indicating that these two items are closely associated than the other items in the model. Thus, there would be an improvement of 0.10 in estimated covariance if these items are covaried (Holmes-Smith, 2011). However, Hair et al. (2010) suggest that the researchers should avoid model re-specification that involves correlated error terms without a valid justification.

Form the above it is clear that the MLIN_5 and MLIN_3 are the weakest items in this model as they have lower SRWs and SMCs than the recommended thresholds 0.5 and 0.3. Therefore, the weakest item, MLIN_5 was first deleted from the model (Holmes-Smith, 2011). The model has been re-estimated for its validity after deleting MLIN_5. The model fit statistics of re-specified model are presented in Table 5.6.

Table 5-6: Statistical results for the re-specified one factor congeneric model of MLIN variable

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.239	CFI	0.992
No. of estimated parameters	13	X^2	4.399	TLI	0.975
DF	2	(X^2/DF)	2.200	RFI	0.955
Model is identified		RMSEA	0.078	AGFI	0.946
		SRMR	0.025	PCLOSE	0.231

The model fit statistics indicate that the model is identified with two degrees of freedom. All GOF statistical results (Normed chi-square (2.2), RMSEA (0.08), SRMR (0.025), CFI (0.99), TLI (0.97), RFI (0.95), AGFI (0.95) and PCLOSE (0.23)) are within or closer to the acceptable ranges. This suggests that the one factor congeneric model of multi-level information (MLIN) now fits well. Therefore, this model is acceptable.

5.4.2 One factor congeneric measurement model of MPIN

The initial path diagram of the multi-purpose information (MPIN) variable is shown in Figure 5.4.

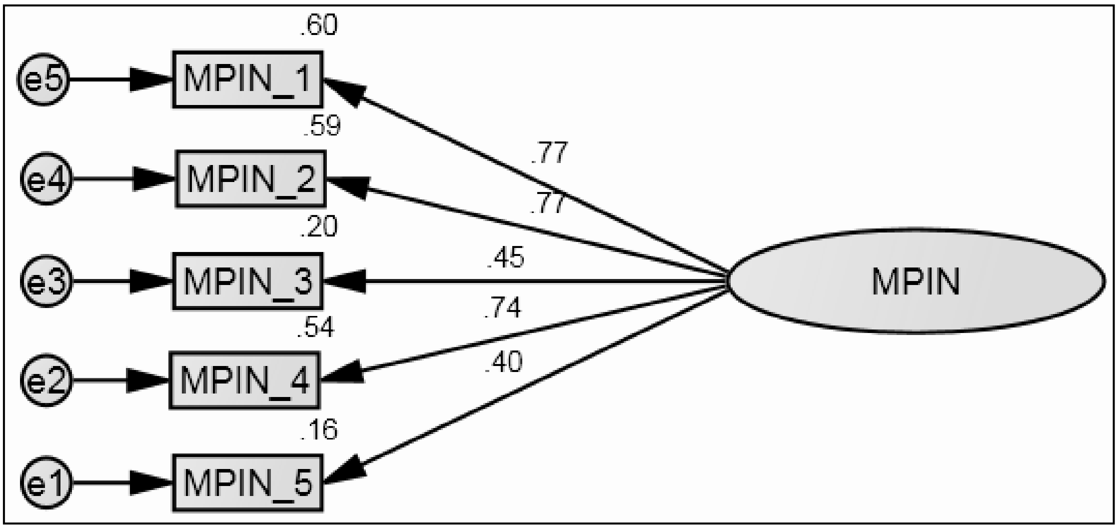


Figure 5-4: Initial path diagram of the MPIN congeneric measurement model.

The above figure indicates that the MPIN variable consists of five indicator items. These items include detailed information, summarised information, independent information, real time information on legal reporting, real time information on tax planning and real-time information on supply chain management. SRW of indicator variables, MPIN_1, MPIN_2, MPIN_3, MPIN_4, and MPIN_5 are 0.77, 0.77, 0.45, 0.74 and 0.40 respectively. SMC of these items are 0.60, 0.59, 0.20, 0.54 and 0.16 respectively. This indicates that the items MPIN_3 and MPIN_5 might cause model misfit. Model identification and GOF statistics are examined to identify the validity of this model. These are presented in Table 5.7.

Table 5-7: Statistical results of the MPIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.005	CFI	0.865
No. of estimated parameters	16	X^2	42.805	TLI	0.730
DF	5	(X^2/DF)	8.561	RFI	0.705
Model is identified		RMSEA	0.197	AGFI	0.769
		SRMR	0.092	PCLOSE	0.000

As shown in Table 5.7, one factor congeneric measurement model of MPIN is identified with a chi-square of 42.8, 5 DF and a p-value of 0.005. However, all the GOF statistics are outside the acceptable ranges. Therefore, this model does not fit and it needs to be re-specified. MPIN_3 and MPIN_5 may explain the model misfit as these two items have very low SRWs and SMCs as shown in Figure 5.4. This has been further examined using model re-specification diagnostic measures. Results of the model re-specification diagnostic measures are shown in Table 5.8.

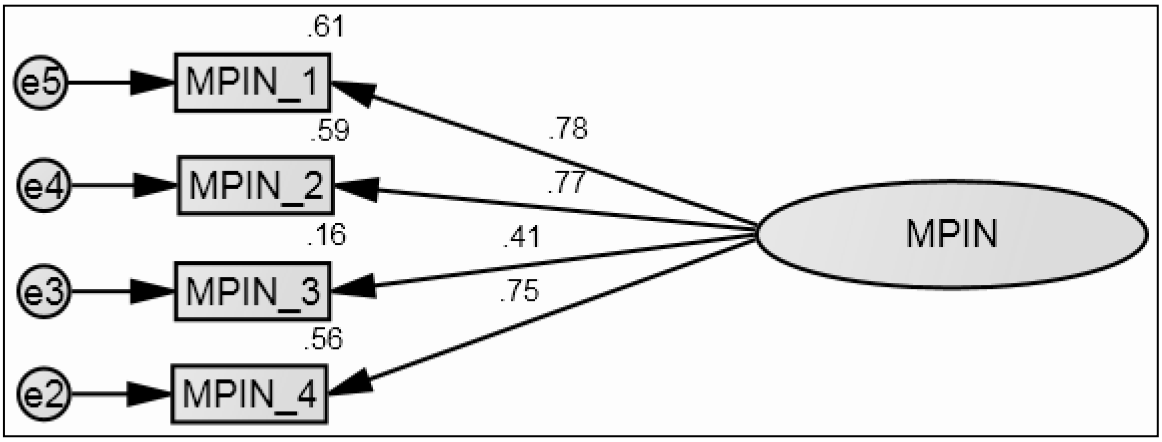
Table 5-8: Model re-specification diagnostic measures of one factor MPIN congeneric measurement model

Standardized Residual Covariances (SRC)						Modification indices				
Item	MPIN_1	MPIN_2	MPIN_3	MPIN_4	MPIN_5				M.I.	Par Change
MPIN_1	0.000					e2	<-->	e3	4.95	-0.09
MPIN_2	-0.070	0.000				e1	<-->	e3	36.35	0.25
MPIN_3	-0.276	0.093	0.000							
MPIN_4	0.309	0.135	-1.112	0.000						
MPIN_5	-0.512	-0.295	**4.667**	-0.628	0.000					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
MPIN_1	<---	MPIN	0.773	0.597	4.974	***				
MPIN_2	<---	MPIN	0.768	0.590	5.014	***				
MPIN_3	<---	MPIN	0.449	0.201	4.342	***	SRW & SMC are low			
MPIN_4	<---	MPIN	0.737	0.543	4.910	***				
MPIN_5	<---	MPIN	0.401	0.161			SRW & SMC are low			
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations										

Note: *** p< 0. 001 (two -tailed)

The above analysis indicates that the SRC, SRW and SMC of MPIN_3 and MPIN_5 are outside the acceptable ranges causing model misfit. The model has been re-specified deleting MPIN_5. The path diagram and GOF statistics for the re-specified model are presented below.

Path diagram and GOF statistics of option 1 (After deleting MPIN_5)



Model identification		GOF statistics			
No. of observed variables	4	Bootstrap p	0.254	CFI	0.995
No. of estimated parameters	13	X^2	3.053	TLI	0.986
DF	2	(X^2/DF)	1.526	RFI	0.959
Model is identified		RMSEA	0.052	AGFI	0.962
		SRMR	0.023	PCLOSE	0.369

With a chi-square of 3.05, 2 DF and a p- value of 0.254, this model now fits well. The other model fit indices: Normed chi-square (1.5), RMSEA (0.05), SRMR (0.023), CFI (0.99), TLI (0.99), RFI (0.96), AGFI (0.96) and PCLOSE (0.40)) are also within the acceptable ranges.

5.4.3 One factor congeneric measurement model of ATIN

The proposed congeneric measurement model of accurate and timely information (ATIN) consists of four observed variables. Figure 5.5 illustrates the initial path diagram while Table 5.9 presents the model's GOF statistics.

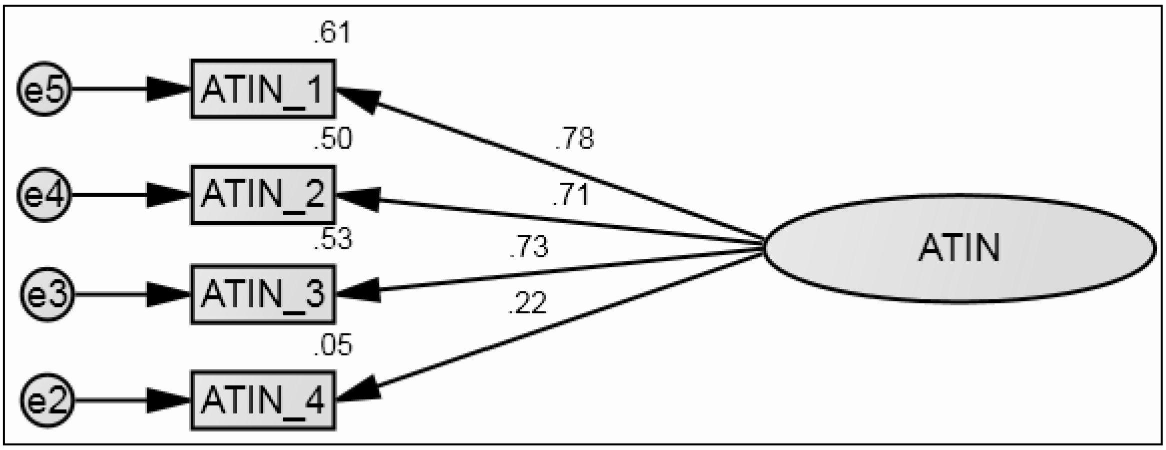


Figure 5-5: Initial path diagram of the ATIN congeneric measurement model

Table 5-9: GOF statistics of the ATIN congeneric measurement model

Model identification				**GOF statistics**			
No. of observed variables			4	Bootstrap p	0.189	CFI	0.998
No. of estimated parameters			13	X^2	2.317	TLI	0.994
DF			2	(X^2/DF)	1.158	RFI	0.960
Model is identified				RMSEA	0.028	AGFI	0.971
				SRMR	0.022	PCLOSE	0.474
Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
ATIN_1	<---	ATIN	0.780	0.608			
ATIN_2	<---	ATIN	0.706	0.498	8.117	***	
ATIN_3	<---	ATIN	0.730	0.534	8.108	***	
ATIN_4	<---	ATIN	0.220	0.048	2.663	0.008	SRW & SMC are low
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations							

Note: *** p< 0. 001 (two -tailed)

With a chi-square of 2.317, 2 DF and a p- value of 0.189, this model fits well. Other GOF statistics (Normed chi-square (1.16), RMSEA (0.03), SRMR (0.02), CFI (0.99), TLI (0.99), RFI (0.96), AGFI (0.97) and PCLOSE (0.47)) are also within the acceptable ranges. However, it can be seen that SRW (0.220) and SMC (0.048) of item ATIN_4 is very low and outside the accepted thresholds of 0.5 and 0.3. Therefore, this item becomes the candidate for deletion. Revised statistics after deleting ATIN_4 are shown in Table 5.10.

Table 5-10: Statistical results of the re-specified ATIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	3	Bootstrap p	0.209	CFI	0.996
No. of estimated parameters	10	X^2	1.631	TLI	0.988
DF	1	(X^2/DF)	1.631	RFI	0.970
Model is identified		RMSEA	0.057	AGFI	0.967
		SRMR	0.018	PCLOSE	0.306

With a chi-square of 1.631, 1 DF and a p- value of 0.209, this model now fits well. Other GOF statistics are also within the accepted thresholds. Thus, this model has been accepted as a good fitting model.

5.4.4 One factor congeneric measurement model of CIN

The initial path diagram of the one factor congeneric model of consolidated information (CIN) consists of five indicator variables (CIN_1 to CIN_5). The path diagram and GOF statistics regarding this model are shown below.

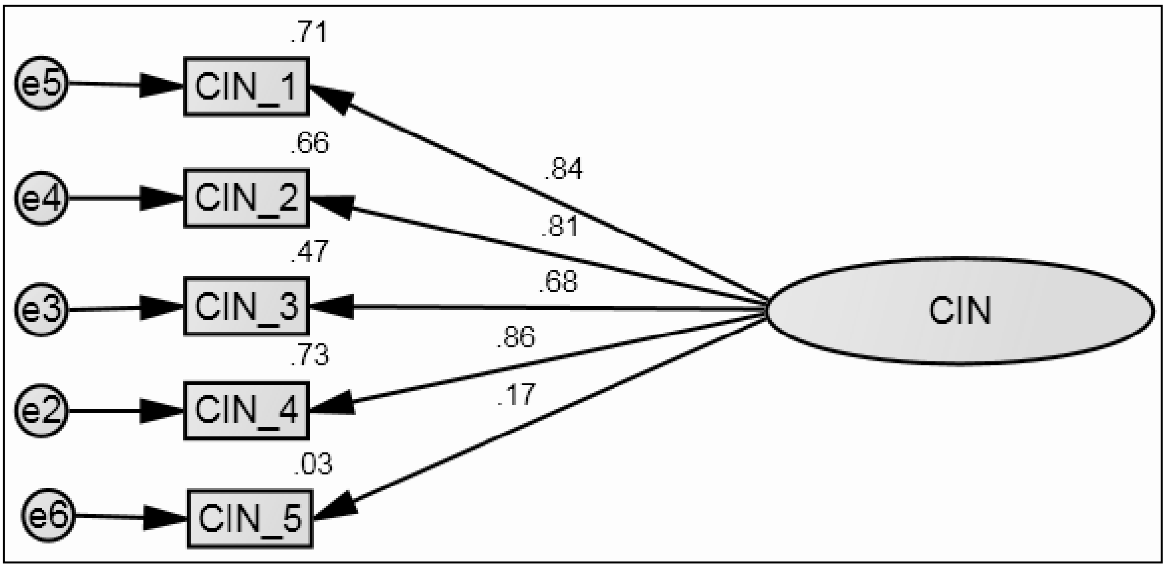


Figure 5-6: Initial path diagram of the CIN congeneric measurement model

Table 5-11: GOF statistics of the CIN congeneric measurement model

Model identification				**GOF statistics**				
No. of observed variables		5	Bootstrap p		0.264	CFI		0.996
No. of estimated parameters		16	X^2		6.457	TLI		0.993
DF		5	(X^2/DF)		1.291	RFI		0.969
Model is identified			RMSEA		0.039	AGFI		0.962
			SRMR		0.021	PCLOSE		0.514
Factor loadings								
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**	
CIN_1	<---	CIN	0.841	0.707				
CIN_2	<---	CIN	0.809	0.655	12.488	***		
CIN_3	<---	CIN	0.683	0.467	10.333	***		
CIN_4	<---	CIN	0.856	0.733	13.527	***		
CIN_5	<---	CIN	0.168	0.028	2.225	0.026	SRW & SMC are low	
DF: Degree of freedom								
SRW: Standardised regression weight								
CR: Critical ratio								
SMC: Squared multiple correlations								

Note: *** p< 0. 001 (two -tailed)

The above analysis indicates that with a chi-square of 6.457, 5 DF and a p-value of 0.264 this model fits well. However, SRW (0.168) and SMC (0.028) of CIN_5 are very low compared to those of other items and the recommended thresholds of 0.5 and 0.3. MI and SRC did not suggest that this model needed any modification. It was therefore re-specified by deleting CIN_5. The path diagram and GOF statistics for the re-specified model are presented below.

Table 5-12: GOF statistics of the re-specified CIN measurement model

Model identification				**GOF statistics**			
No. of observed variables			4	Bootstrap p	0.095	CFI	0.994
No. of estimated parameters			13	X^2	4.229	TLI	0.983
DF			2	(X^2/DF)	2.115	RFI	0.969
Model is identified				RMSEA	0.076	AGFI	0.948
				SRMR	0.017	PCLOSE	0.245
Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
CIN_1	<---	CIN	0.838	0.703			
CIN_2	<---	CIN	0.811	0.657	12.486	***	
CIN_3	<---	CIN	0.684	0.468	10.323	***	
CIN_4	<---	CIN	0.857	0.735	13.510	***	
DF: Degree of freedom							
SRW: Standardised regression weight							
CR: Critical ratio							
SMC: Squared multiple correlations							

Note: *** p< 0. 001 (two -tailed)

Model fit statistics discussed in the above table clearly indicate that this model is a good fitting model, even though the normed chi-square (2.115) is slightly higher than the accepted range (between 1 and 2).

5.4.5 One factor congeneric measurement model of GBPIN

Unlike other congeneric measurement models, global business process information (GBPIN) variable is loaded with seven indicator variables. The initial path diagram and GOF statistics of this model are presented below.

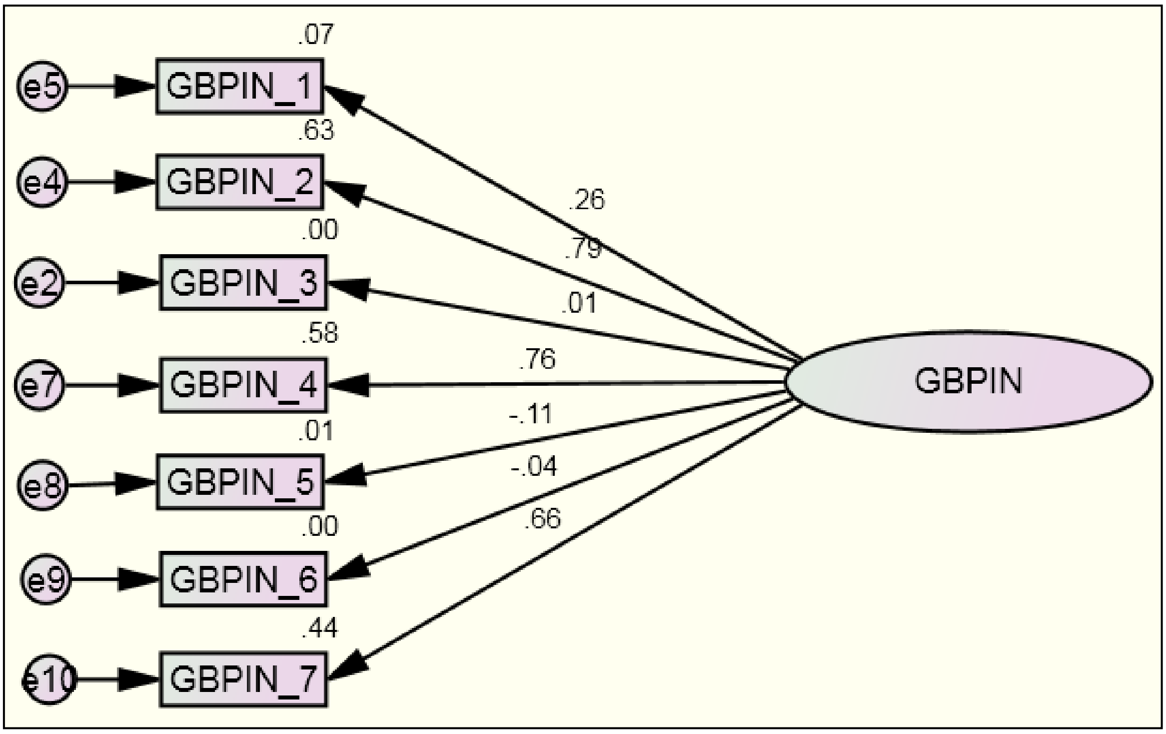


Figure 5-7: Initial path diagram of the GBPIN congeneric measurement model

Table 5-13: GOF statistics of the GBPIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	7	Bootstrap p	0.005	CFI	0.875
No. of estimated parameters	22	X^2	38.514	TLI	0.813
DF	14	(X^2/DF)	2.751	RFI	0.735
Model is identified		RMSEA	0.095	AGFI	0.894
		SRMR	0.072	PCLOSE	0.020

This model is identified with a chi-square of 38.514, 14 DF and a p-value of 0.005. However, this model does not fit as most of the GOF statistics are outside the acceptable range, except SRMR (0.07). Therefore, it was re-specified and the model re-specification statistics are presented in Table 5.14 and discussed below.

Table 5-14: Model re-specification statistics

Standardized Residual Covariances (SRC)								Modification indices				
Item	GBPIN_7	GBPIN_6	GBPIN_5	GBPIN_4	GBPIN_1	GBPIN_2	GBPIN_3				M.I.	Par Change
GBPIN_1	0.390	**3.554**	0.815	-0.851	0.000			e8	<-->	e10	5.16	-0.12
GBPIN_2	-0.198	-0.117	0.132	0.045	0.612	0.000		e5	<-->	e9	13.77	0.14
GBPIN_3	-1.256	0.410	1.605	0.399	1.081	0.297	0.000					
GBPIN_4	0.126	-0.947	0.759	0.000								
GBPIN_5	-1.553	1.762	0.000									
GBPIN_6	1.000	0.000										
GBPIN_7	0.000											

Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
GBPIN_1	<---	GBPIN	0.258	0.067			
GBPIN_2	<---	GBPIN	0.794	0.631	3.242	0.001	
GBPIN_3	<---	GBPIN	0.007	0.000	0.081	0.935	SRW, SMC & CR are very low
GBPIN_4	<---	GBPIN	0.761	0.579	3.107	0.002	
GBPIN_5	<---	GBPIN	-0.107	0.011	-1.227	0.220	SRW, SMC & CR are very low
GBPIN_6	<---	GBPIN	-0.044	0.002	-0.532	0.594	SRW, SMC & CR are very low
GBPIN_7	<---	GBPIN	0.660	0.436	3.130	0.002	

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

It is apparent from the above that GBPIN_1, GBPIN_3, GBPIN_5 and GBPIN_6 are the poor fitting items in this model. These items might be the reason for model misfit. SRC value (3.554) between GBPIN_1 and GBPIN_6 is very high. SRW, SMC and CR of GBPIN_3, GBPIN_5 and GBPIN_6 are significantly low. Modification indices suggest that if e5 and e9 were covaried, the chi-square would improve by 13.77. However, this suggestion did not improve the model fit. This emphasises that the items GBPIN_3, GBPIN_5 and GBPIN_6, are not consistent with other items. Therefore, these items were deleted and a new measurement model was estimated. Results of the re-specified model are discussed below.

Model identification		GOF statistics			
No. of observed variables	4	Bootstrap p	0.239	CFI	0.990
No. of estimated parameters	13	X^2	3.793	TLI	0.969
DF	2	(X^2/DF)	1.897	RFI	0.937
Model is identified		RMSEA	0.068	AGFI	0.953
		SRMR	0.027	PCLOSE	0.286

The above fit statistics indicate that one factor congeneric model of GBPIN is now fitting well with a chi-square of 3.793, 2 DF and a p-value of 0.239. The other fit statistics also fall within the acceptable ranges.

5.4.6 One factor congeneric measurement model of GSCIN

The path diagram and the statistical results of one factor congeneric measurement model of global supply chain information (GSCIN) are shown in Figure 5.8 and Table 5.15, respectively. Similar to other models this model is loaded with five indicator variables, namely GSCIN_1 (improve operational efficiency), GSCIN_2 (deliver better service to customers), GSCIN_3 (better inventory managements), GSCIN_4 (optimize production processes), GSCIN_5 (reduce costs associated with supply chain activities).

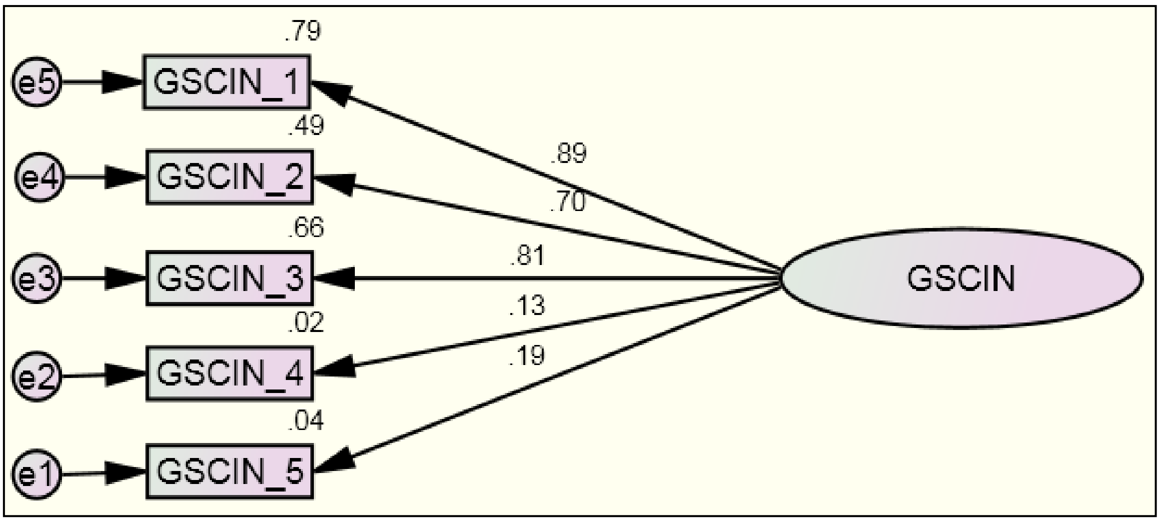


Figure 5-8: Initial path diagram of the GSCIN congeneric measurement model

Table 5-15: Model fit statistics

Model identification		GOF statistics			
No. of observed variables	5	Bootstrap p	0.005	CFI	0.878
No. of estimated parameters	16	X^2	40.258	TLI	0.757
DF	5	(X^2/DF)	8.052	RFI	0.731
Model is identified		RMSEA	0.190	AGFI	0.785
		SRMR	0.101	PCLOSE	0.000

The above results indicate that the one factor measurement model of GSCIN does not fit. Normed chi-square (8.052) is higher than the recommended range between 1 and 2 with a very poor p-value (0.005). Furthermore, RMSEA (0.19) and SRMR (0.10) are well above the recommended value of 0.08. CFI (0.88), TLI (0.76), RFI (0.73), AGFI (0.78) and PCLOSE (0.00) are also not within the acceptable ranges. These results indicate the necessity of re-specifying the one factor GSCIN measurement model. Results of model re-specification diagnostic measures are presented in Table 5.16.

Table 5-16: Model re-specification statistics

Standardized Residual Covariances (SRC)						Modification indices				
	GSCIN_1	GSCIN_2	GSCIN_3	GSCIN_4	GSCIN_5				M.I.	Par Change
GSCIN_1	0.000					e2	<-->	e5	4.56	-0.07
GSCIN_2	0.089	0.000				e2	<-->	e3	6.79	0.09
GSCIN_3	-0.005	-0.110	0.000			e1	<-->	e2	28.50	0.25
GSCIN_4	-0.682	-0.870	1.292	0.000						
GSCIN_5	-0.183	-0.153	0.131	**5.176**	0.000					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
GSCIN_1	<---	GSCIN	0.890	0.793	2.479	0.013				
GSCIN_2	<---	GSCIN	0.699	0.489	2.466	0.014				
GSCIN_3	<---	GSCIN	0.814	0.662	2.497	0.013				
GSCIN_4	<---	GSCIN	0.131	0.017	1.446	0.148	SRW & SMC are low			
GSCIN_5	<---	GSCIN	0.190	0.036			SRW & SMC are low			

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

The model re-specification diagnostic measures presented above reveal that the SRC value (5.176) between GSCIN_4 and GSCIN_5 is very high. Furthermore, SRW and SMC values of these items are below the acceptable ranges of 0.5 and 0.3. However, modification indices suggest that there is a correlation between e1 and e2, those are the error variances of GSCIN_4 and GSCIN_5, which is not explained by GSCIN alone. If these error variances are covaried, chi-square of the model can be improved by 28.5 units. However, this suggestion did not improve the model fit. Therefore, the model was re-specified by deleting GSCIN_4 and GSCIN_5. As shown in Table 5.17, the re-specified model achieved a good fit with a chi-square of 1.740, 1 DF and a p-value of 0.204. All the other model fit statistics also fall within the acceptable ranges.

Table 5-17: GOF statistics of the re-specified GSCIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	3	Bootstrap p	0.204	CFI	0.997
No. of estimated parameters	10	X^2	1.740	TLI	0.991
DF	1	(X^2/DF)	1.740	RFI	0.979
Model is identified		RMSEA	0.062	AGFI	0.965
		SRMR	0.013	PCLOSE	0.289

5.4.7 One factor congeneric measurement model of SIN

Secure information (SIN) is the last one factor congeneric measurement model for global business information requirements construct. As presented in the path diagram, (see Figure 5.9) this variable consists of four indicator variables, specifically SIN_1, SIN_2, SIN_3, and SIN_4.

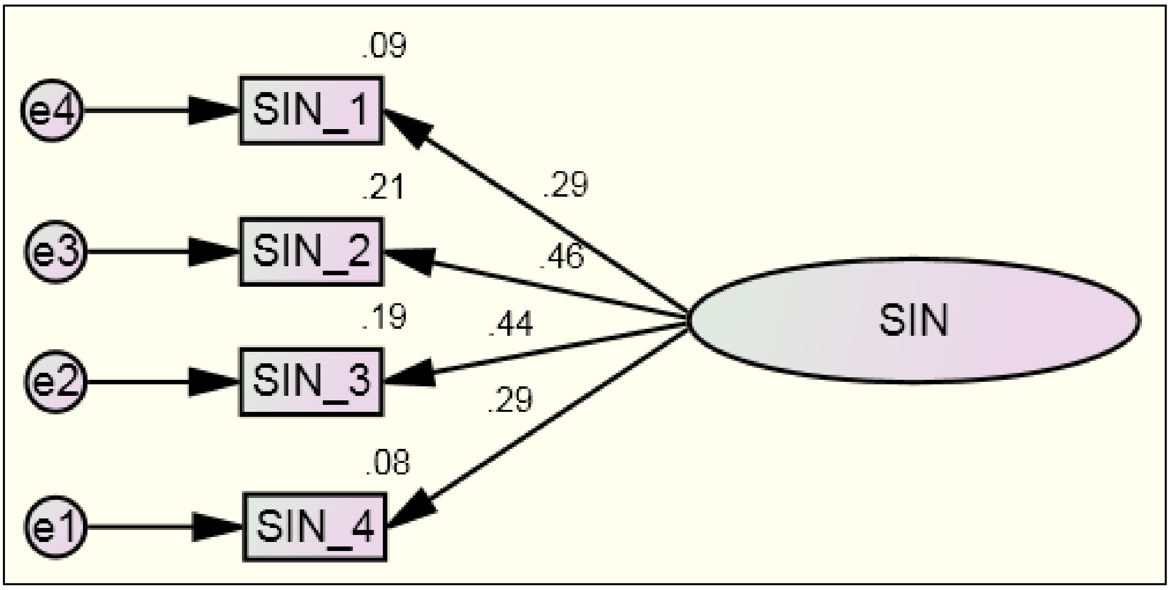


Figure 5-9: Initial path diagram of the SIN congeneric measurement model

GOF statistics of the SIN variable are presented in Table 5.18 and discussed below.

Table 5-18: Model fit statistics of SIN variable

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.025	CFI	0.815
No. of estimated parameters	13	X^2	5.582	TLI	0.444
DF	2	(X^2/DF)	2.791	RFI	0.339
Model is identified		RMSEA	0.096	AGFI	0.926
		SRMR	0.047	PCLOSE	0.151

This model is identified with a chi-square of 5.582, 2 DF and a p-value of 0.025. However, most of the GOF statistics are not within the acceptable ranges except SRMR (0.05) and PCLOSE (0.15). Hence, this model was re-specified and the model re-specification diagnostics measures are presented in Table 5.19.

Table 5-19: Model re-specification diagnostics measures of SIN variable

Standardized Residual Covariances (SRC)					**Modification indices**				
Item	SIN_1	SIN_2	SIN_3	SIN_4				M.I.	Par Change
SIN_1	0.000								
SIN_2	-0.703	0.000							
SIN_3	1.166	-0.230	0.000						
SIN_4	-0.723	1.125	-0.771	0.000					
Factor loadings									
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**		
SIN_1	<---	SIN	0.29	0.09	0.93	0.35	SRW, SMC & CR are		
SIN_2	<---	SIN	0.46	0.21	2.17	0.03	SMC & CR are low		
SIN_3	<---	SIN	0.44	0.19	0.98	0.33	SRW, SMC & CR are		
SIN_4	<---	SIN	0.29	0.08			SRW, SMC & CR are		
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations									

It is clear from the above table that SRC of all the items are within the acceptable range. However, SRW, SMC, CR and p-values for all items are not within the acceptable ranges. Furthermore, SRW, SMC, CR and p-values for every item in this model are very low compared to the other models in global business information requirements construct. Modification indices do not provide any suggestion for improvements to the model. Therefore, this model may not fit well in the full measurement model and may have to be deleted from it.

The analysis of one factor congeneric measurement models concerning global business information requirements construct indicated that some indicator variables were not fitted well with some measurement models. These models were re-specified deleting those loosely fitted indicators. It is also clear that the GOF statistics for the SIN variable are very poor compared to the other variables. Therefore, this variable may not fit well with global business information requirements construct. In order to confirm this, the reliability and validity of the SIN variable were assessed. Assessment of reliability and validity will help to understand the contribution of each indicator variable in representing its associated construct (Hair et al., 2010). It also ensures how well the combined set of indicator variables represents a construct (Hair et al., 2010). The next section discusses the reliability and validity of global business information requirements construct.

5.4.8 Reliability and validity

Assessment of reliability and validity are very important criteria in quantitative research (Bryman and Bell, 2007). Reliability ensures that the instrument is free from random errors and validity ensures that the instrument is a perfect representation of the variables that the researchers intend to measure (Holmes-Smith, 2011). Reliability is concerned with the question of whether a study's results are repeatable or stable (Bryman and Bell, 2007). Therefore, it is an important concern in quantitative studies that are more concerned about the stability of the measure (Bryman and Bell, 2007). Validity is concerned with the integrity of the findings that are generated from the research (Bryman and Bell, 2007).

Improving reliability and validity ensure that the impact of measurement errors (type 1 and 2) are minimised (Hair et al., 2010). However, reliability does not guarantee validity, or vice versa (Holmes-Smith, 2011). Reliability and validity have different meanings when evaluating the accuracy of concepts (Bryman and Bell, 2007). A measure can be reliable but not valid, particularly if it is measuring something consistently but is consistently measuring the wrong construct. Similarly, a measure can be valid but not reliable if it is measuring the right construct, but not doing so in a consistent manner (Bhattacherjee, 2012). Measuring both, reliability and validity are important for deciding the accuracy of a construct (Hair et al., 2010; Bryman and Cramer, 2011; Bhattacherjee, 2012). Therefore, both reliability and validity were established in this research.

5.4.8.1 Reliability

Reliability is the degree to which a variable or a set of variables is consistent or dependable in what it is intended to measure (Byrne, 2010; Hair et al., 2010). In other words, it ensures that if we use the same scale to measure the same construct multiple times, do we get similar results each time, assuming the underlying phenomenon has not changed (Bhattacherjee, 2012). Reliability is inversely related to measurement error and high reliability ensures a lower measurement error (Hair et al., 2010). When reliability is high, the relationship between a construct and indicators becomes stronger, thus indicating that the construct explains more of the variance in each indicator (Hair et al., 2010). It should also be noted that reliability implies consistency but not accuracy (Bhattacherjee, 2012).

Reliability of an instrument can be measured using several methods including: squared multiple correlations (SMC), average variance extracted (AVE), construct reliability, Werts, Rock, Linn, and Joreskog's maximised reliability, Hancock and Mueller's maximised reliability and reliability coefficient (cronbach's alpha) (Hair et al., 2010; Holmes-Smith, 2011).

1) Squared multiple correlations (SMC)

   This method is perhaps the least complicated method and in a good observed variable, the value of SMC should exceed 0.50.

2) Average variance extracted (AVE) estimate

The formula of AVE is displayed below.

$$\text{AVE} = \frac{\sum \lambda^2}{\sum \lambda^2 + \sum \theta}$$

‘’λ’ is the standardised loading for each observed variable and ‘θ’ is the error variance associated with each observed variance. AVE value should exceed 0.50 for an observed variable to be accepted.

3) Construct reliability

This method is similar to the average variance extracted method, but differs in that the standardised loadings are summed before they are squared.

4) Werts, Rock, Linn, and Joreskog’s maximised reliability

This method is quite complicated and requires using matrix algebra to compute reliability.

5) Reliability co-efficient (Cronbach’s alpha)

This method measures reliability by computing reliability co-efficient (Cronbach’s alpha) of each variable. The value of Cronbach’s alpha varies between 0 and 1 and the closer the value to 1, the greater the reliability of the items in the instrument (George and Mallery, 2011).

6) Hancock and Mueller’s maximised reliability (Coefficient H)

This method is equivalent to Werts, Rock, Linn, and Joreskog’s maximised reliability method but it can be computed without the use of matrix algebra.

Furthermore, this method has several advantages over the other methods. These include:

(a) Items with a negative factor loading do not detract from reliability of the composite.

(b) All variables contribute something to the definition of the construct. Therefore, every item adds to the reliability of the composite.

(c) The reliability of the composite will always be larger than the item reliability of the single best indicator variable. Coefficient H value of 0.70 or higher is accepted for construct reliability (Hancock and Mueller, 2001).

The formula of Hancock and Mueller's coefficient H is presented below.

$$H = \frac{1}{\left[1 + \left[\dfrac{1}{\dfrac{\lambda_1^2}{1-\lambda_1^2} + \dfrac{\lambda_2^2}{1-\lambda_2^2} + \dots + \dfrac{\lambda_n^2}{1-\lambda_n^2}}\right]\right]}$$

"λ" is standardised factor loadings.

This research uses reliability co-efficient, Hancock and Mueller's coefficient H, AVE and SMC to measure reliability of the research model.

5.4.8.2 Validity

Validity refers to the extent to which the measure adequately represents the underlying construct that it is supposed to measure (Bhattacherjee, 2012) or the extent to which research instrument is accurate and centred on validating summated scales (Hair et al., 2010). It is the extent to which a measure or set of measures correctly represents the concept of the study or the degree to which it is free from any systematic or non-random errors (Byrne, 2010; Hair et al., 2010). Construct validity consists of three main components, these being convergent validity, discriminant validity and face validity (Hair et al., 2010).

5.4.8.3 Convergent validity

Convergent validity refers to the closeness with which a measure relates to the construct that it is intended to measure (Bhattacherjee, 2012) or the extent to which indicators of a specific construct share a high proportion of variance in common (Hair et al., 2010). The convergent validity can be measured in several ways (Hair et al., 2010). The first method is to use standardised factor loadings (SFL). The convergent validity is achieved when factor loading is significantly different from zero (Holmes-Smith, 2011). High factor loadings indicate that the instrument has high convergent validity, and the accepted value of standardised factor loading is 0.50 or greater (Hair et al., 2010). The second method is to use average variance extracted (AVE) (Hair et al., 2010). AVE is computed as the total of all squared standardised factor loading (squared multiple correlations) divided by the number of items (Hair et al., 2010). An AVE of 0.50 or higher is adequate to achieve convergent validity while the final method of assessing convergent validity is to compute the construct’s reliability (Hair et al., 2010). Reliability of 0.70 or higher suggests a good reliability; however, reliability between 0.6 and 0.7 is also acceptable in applied research (Hair et al., 2010). SFL, AVE and Cronbach’s alpha will be used to measure convergent validity in this research.

5.4.8.4 Discriminant validity

Discriminant validity measures the extent to which a construct is truly distinct from other constructs in terms of how much it correlates with others and how distinctly measured variables represent only a single construct (Hair et al., 2010; Bhattacherjee, 2012). It tests whether the indicators of constructs are different enough to conclude that they are measured separate constructs (Holmes-Smith, 2011). Therefore, it ensures that the construct is unique and captures some phenomena that other measures do not (Hair et al., 2010). In other words, it tests whether the indicators of two constructs are truly measured two separate constructs (Holmes-Smith, 2011).

Discriminant validity can be ascertained using chi-square difference test and AVE method (Hair et al., 2010; Holmes-Smith, 2011). Chi-square difference test is considered as a more rigorous and widely accepted SEM based method of measuring discriminant validity (Holmes-Smith, 2011). It compares chi-square of constrained and unconstrained models and if results are significantly different then it concludes that the discriminant validity prevails (Hair et al., 2010; Holmes-Smith, 2011). In this method, first run the unconstrained model and note the chi-square. The second step is to constrain the correlation between constructs to 1.00 and note the chi-square. If this test shows that constraining the correlation between the two constructs significantly worsens the model fit then it can be concluded that these two constructs measure two different constructs and have discriminant validity. AVE method involves comparison of AVE for any two constructs with the square of the correlation estimate between those two constructs (Hair et al., 2010; Holmes-Smith, 2011). In this research chi-square difference test will be employed to measure discriminant validity.

5.4.8.5 Face validity

Face validity is the assessment of correspondence of the variables that are included in a summated scale (Hair et al., 2010). It ensures that the indicator is a reasonable measure of its underlying construct "on its face" (Bhattacherjee, 2012). Face validity can be assessed through rating by expert judges and pre-testing the instrument with multiple subpopulations (Hair et al., 2010).

In summary, the reliability of the research instrument can be measured using squared multiple correlations (SMC), average variance extracted (AVE), construct reliability, Werts, Rock, Linn, and Joreskog's maximised reliability, Hancock and Mueller's maximised reliability and reliability coefficient (Cronbach's alpha). Discriminant validity can be ascertained using chi-square difference test and AVE method.

This research used reliability coefficient (Cronbach's alpha), Hancock and Mueller's coefficient H and AVE to measure reliability of the variables. Item reliability of the research instrument was measured using SMC. Convergent validity was established using SFL, AVE and reliability of the construct (Cronbach's alpha). Discriminant validity was ascertained using the chi-square difference test method. These are discussed in more detail in the following section.

5.4.9 Reliability and convergent validity of GBIR construct

This section discusses reliability and validity of re-specified global business information requirements (GBIR) construct. Table 5.20 presents the results of reliability and convergent validity tests for re-specified global business information requirements construct.

Table 5-20: Reliability and convergent validity tests of re-specified global business information requirements construct

Item	Variable	Reliability			Convergent validity				Remarks
		Cronbach's alpha	H	AVE	SMC	SFL	AVE	Cronbach's alpha	
MLIN_1	**Multi-level information**	0.88	0.87	0.66	0.79	0.89	0.66	0.88	Reliability & convergent validity hold
MLIN_2					0.54	0.73			Reliability & convergent validity hold
MLIN_4					0.66	0.81			Reliability & convergent validity hold
MPIN_1	**Multi-purpose information**	0.87	0.81	0.59	0.59	0.77	0.59	0.87	Reliability & convergent validity hold
MPIN_2					0.57	0.76			Reliability & convergent validity hold
MPIN_4					0.60	0.77			Reliability & convergent validity hold
ATIN_1	**Accurate and timely information**	0.85	0.78	0.54	0.56	0.75	0.54	0.85	Reliability & convergent validity hold
ATIN_2					0.49	0.70			Reliability & convergent validity hold
ATIN_3					0.58	0.76			Reliability & convergent validity hold
CIN_1	**Consolidated information**	0.92	0.89	0.64	0.70	0.84	0.64	0.92	Reliability & convergent validity hold
CIN_2					0.66	0.81			Reliability & convergent validity hold
CIN_3					0.47	0.68			Reliability & convergent validity hold
CIN_4					0.74	0.86			Reliability & convergent validity hold
GBPIN_2	**Global business process information**	0.78	0.79	0.55	0.56	0.75	0.55	0.78	Reliability & convergent validity hold
GBPIN_4					0.62	0.79			Reliability & convergent validity hold
GBPIN_7					0.47	0.68			Reliability & convergent validity hold
GSCIN_1	**Global supply chain information**	0.91	0.86	0.65	0.76	0.87	0.65	0.91	Reliability & convergent validity hold
GSCIN_2					0.49	0.70			Reliability & convergent validity hold
GSCIN_3					0.70	0.83			Reliability & convergent validity hold
SIN_2	**Secure information**	0.33	0.38	0.17	0.20	0.46	0.17	0.33	Reliability & convergent validity fail
SIN_3					0.07	0.28			Reliability & convergent validity fail
SIN_4					0.19	0.46			Reliability & convergent validity fail

Table 5.20 indicates that all the variables, except secure information, achieved appropriate reliability and convergent validity. SFL (more than 0.5), SMC (more than 0.5), AVE (more than 0.5) and H (more than 0.7) are within the recommended ranges or very close to them. It is also apparent that the secure information variable did not achieve sufficient reliability and convergent validity. All the test results (SFL, SMC, AVE and H) of secure information variable are well below the accepted ranges. Therefore, this variable has been dropped from the full measurement model. Only the remaining variables have been considered for measuring the discriminant validity.

5.4.10 Discriminant validity of GBIR construct

Discriminant validity has been measured using the chi-square difference test method. It is done by comparing the chi-square difference of constrained (correlation between two variables - 1.0) and unconstrained models. This test should compare one pair of variables at any one time (Anderson and Gerbing, 1988). For example, discriminant validity of MLIN and MPIN variables has been determined by using two measurement models (unconstrained and constrained) as shown in Figures 5.10 and 5.11.

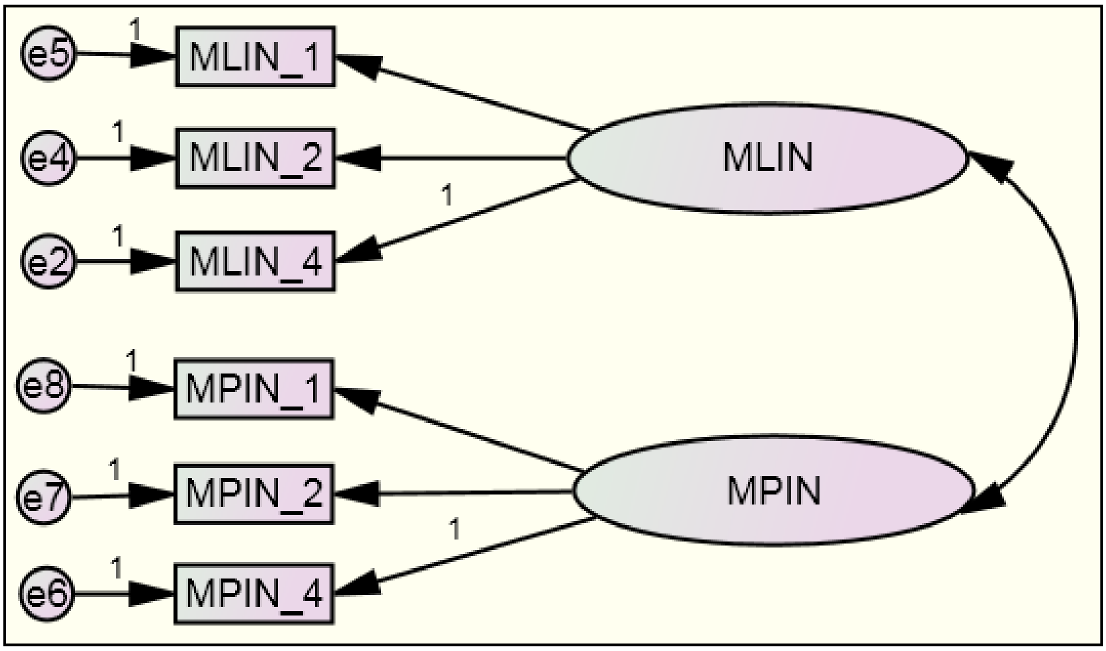


Figure 5-10: Unconstrained model of MLIN and MPIN variables

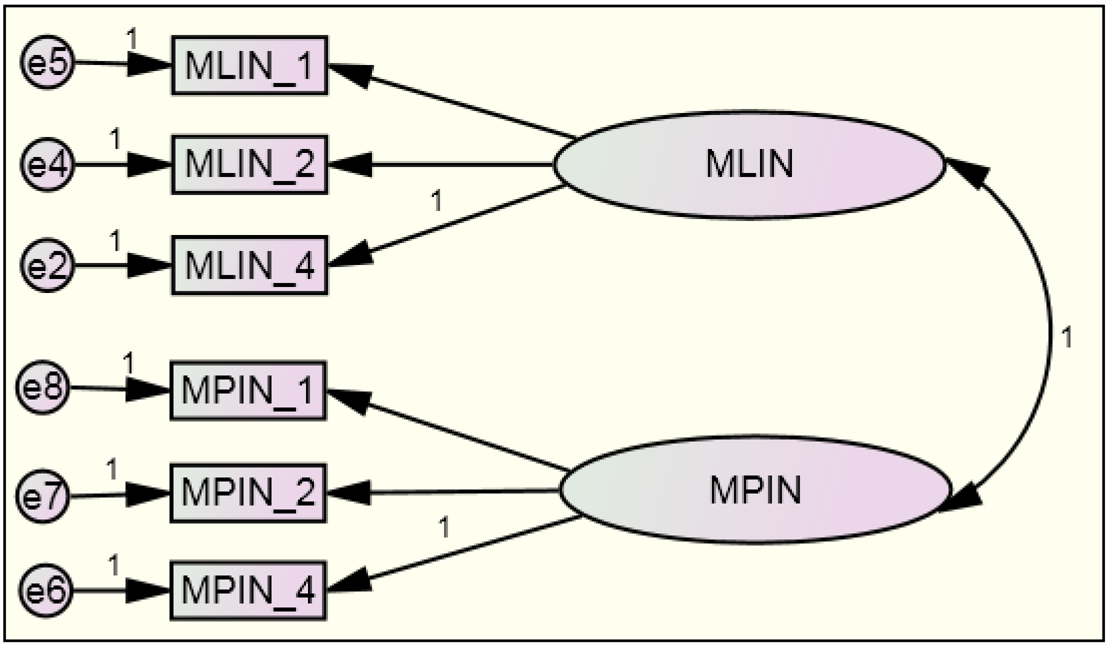


Figure 5-11: Constrained model of MLIN and MPIN variables

The above two models were estimated using ML estimation to obtain the X^2 and DF values of both models. On this basis, chi-square difference test were carried out to determine their discriminant validity. X^2 and DF values of unconstrained and constrained models are 18.16, 60.12, 8 and 9 respectively. This indicates that the X^2 value of unconstrained model is significantly lower than the constrained model. Chi-square difference between constrained and unconstrained model is significant (41.51) with a difference of 1 DF. It can therefore be concluded that the discriminant validity MLIN and MPIN is achieved (p <0.000), thus indicating that these two variables are two separate variables. Similarly, the discriminant validity of other variables was examined using the chi-square difference test. This is presented in Tables 5.21, 5.22 and 5.23.

Table 5-21: Chi-square of unconstrained and constrained models

Variable	MLIN		MPIN		ATIN		CIN		GBPIN		GSCIN	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM
MLIN	-	-										
MPIN	18.61	60.12	-	-								
ATIN	11.65	41.82	9.23	48.24	-	-						
CIN	15.99	37.05	20.76	52.49	15.65	51.21	-	-				
GBPIN	7.30	57.95	5.24	62.32	10.01	77.03	13.73	67.59	-	-		
GSCIN	18.64	37.08	15.66	45.47	8.43	37.46	26.87	46.26	4.47	51.43	-	-
UCM - Unconstrained model												
CM - Constrained model												

Table 5-22: DF of unconstrained and constrained models

Variable	MLIN		MPIN		ATIN		CIN		GBPIN		GSCIN	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM
MLIN	-	-										
MPIN	8.00	9.00	-	-								
ATIN	8.00	9.00	8.00	9.00	-	-						
CIN	13.00	14.00	13.00	14.00	13.00	14.00	-	-				
GBPIN	8.00	9.00	8.00	9.00	8.00	9.00	13.00	14.00	-	-		
GSCIN	8.00	9.00	8.00	9.00	8.00	9.00	13.00	14.00	8.00	9.00	-	-
UCM - Unconstrained model												
CM - Constrained model												

Table 5-23: Chi-square difference test

Variable	MLIN			MPIN			ATIN			CIN			GBPIN			
	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Remarks
MLIN	-	-														Discriminant validity holds
MPIN	41.51	1.00	0.00	-	-											Discriminant validity holds
ATIN	30.17	1.00	0.00	39.01	1.00	0.00	-	-								Discriminant validity holds
CIN	21.06	1.00	0.00	31.72	1.00	0.00	35.55	1.00	0.00	-	-					Discriminant validity holds
GBPIN	50.64	1.00	0.00	57.08	1.00	0.00	67.02	1.00	0.00	53.86	1.00	0.00	-	-		Discriminant validity holds
GSCIN	18.44	1.00	0.00	29.81	1.00	0.00	29.03	1.00	0.00	19.40	1.00	0.00	46.96	1.00	0.00	Discriminant validity holds
Δ X^2	Difference in chi-square															
Δ DF	Difference in degree of freedom															
P	Probability															

The analysis of chi-square difference test shows that all the variables in this model achieved discriminant validity and are truly distinct from each other, for example, the unconstrained model of MPIN has a chi-square of 18.61 with 8 DF. The constrained model, which is the correlation between MLIN and MPIN constructs is constrained to 1.0, has a chi-square of 60.12 with 9 DF. This provides a difference of 41.51 chi-squares with 1 DF and a p-value of 0.000. Therefore, constraining the correlation between MPIN and MLIN to 1 resulted in significantly worsening the model fit. Therefore, it can be concluded that these two constructs are different (discriminant validity holds). All the other variables concerning the global business information requirements construct hold discriminant validity and are significantly different from each other. The next section discusses the final measurement model of global business information requirements construct.

5.4.11 Final measurement model of GBIR construct

It was theorised that global business information requirements construct consists of seven variables. However, the confirmatory factor analysis of one-factor congeneric measurement models and the results of reliability and validity revealed that SIN variable has not well fitted with this construct. It suggests SIN variable needs to be deleted from the full measurement model of global business information requirements. However, prior to deleting this variable the full measurement model of global business information requirements construct was developed, incorporating re-specified one factor congeneric measurement models as discussed in the previous section. The graphical presentation of second order full measurement model of global business information requirements construct and it statistical results are presented in Figure 5.12 and Table 5.24.

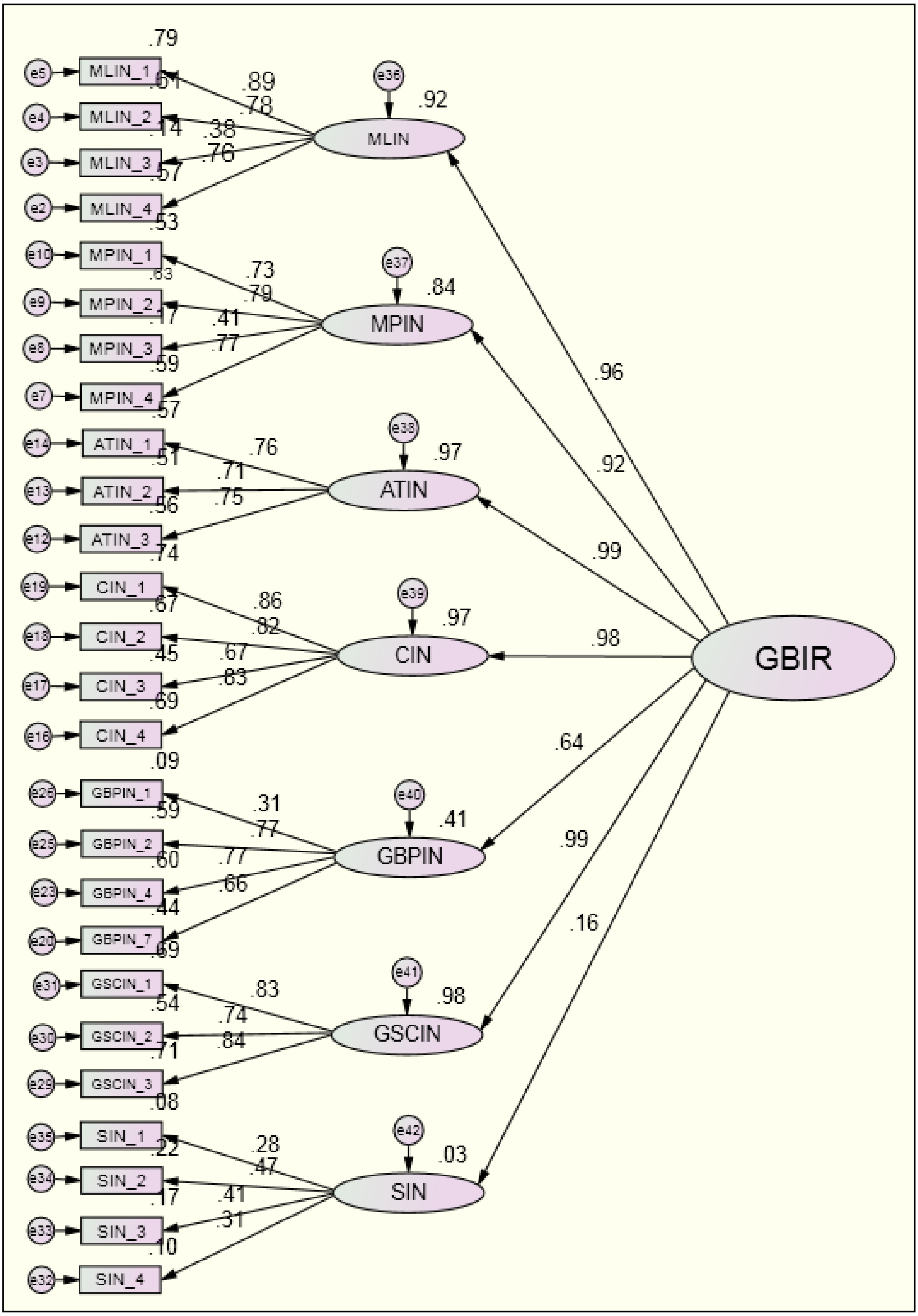


Figure 5-12: Final measurement model of GBIR construct

Table 5-24: GOF statistics of final measurement model of GBIR construct

Model identification		**GOF statistics**			
No. of observed variables	26	Bootstrap p	0.164	CFI	0.965
No. of estimated parameters	100	X^2	381.80	TLI	0.962
DF	292	(X^2/DF)	1.308	RFI	0.855
Model is identified		RMSEA	0.040	AGFI	0.851
		SRMR	0.056	PCLOSE	0.944

Final measurement model of global business information requirements construct is identified with a chi-square of 381.8, 292 DF and a p-value of 0.164. All the GOF statistics are within the acceptable ranges except RFI (0.86) and AGFI (0.85). Based on these results this model can be accepted. However, in order to verify its accuracy, model re-specification diagnostic measures have also been investigated. The selective results of this analysis are presented in Table 5.25.

Table 5-25: Model re-specification diagnostic measures of final measurement model of GBIR construct

Standardized Residual Covariances (SRC)								**Modification indices**				
Item	SIN_1	SIN_2	SIN_3	SIN_4	GBPIN_1	MPIN_3	MLIN_3				M.I.	Par Change
SIN_1	0.000							e3	<-->	e26	22.44	0.14
SIN_2	-0.679	0.000						e3	<-->	e8	14.89	0.16
SIN_3	1.362	-0.160	0.000					e8	<-->	e26	14.32	0.14
SIN_4	-0.762	0.888	-0.805	0.000				e23	<-->	e37	8.48	0.04
GBPIN_1	1.610	2.491	0.838	0.661	0.000			e23	<-->	e26	7.59	-0.09
MPIN_3	-0.867	0.938	0.769	0.491	**4.293**	0.000		e3	<-->	e39	7.31	-0.05
MLIN_3	1.661	0.987	0.046	**2.214**	**4.990**	**3.301**	0	e20	<-->	e37	7.15	-0.04

Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
SIN_1	<---	SIN	0.279	0.078	2.146	0.032	SRW & SMC are low
SIN_2	<---	SIN	0.474	0.225	1.420	0.156	SRW, SMC & CR are low
SIN_3	<---	SIN	0.411	0.169			SRW & SMC are low
SIN_4	<---	SIN	0.312	0.097	1.342	0.180	SRW, SMC & CR are low
GBPIN_1	<---	GBPIN	0.306	0.094	3.832	***	SRW & SMC are low
MPIN_3	<---	MPIN	0.410	0.168	5.585	***	SRW & SMC are low
MLIN_3	<---	MLIN	0.380	0.144	5.234	***	SRW & SMC are low

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

Note: *** p< 0. 001 (two -tailed)

Model re-specification diagnostic measures of global business information requirements construct indicate that SRW, SMC and CR of all the items, except SIN_1, SIN_2, SIN_3, SIN_4, GBPIN_1, MPIN_3 and MLIN_3, are within the acceptable ranges. The analysis shown in Table 5.25 demonstrates that SRC between MPIN_3 and MLIN_3, MLIN_3 and GBPIN_1, MPIN_3 and GBPIN_1 and SIN_4 and MLIN_3 are very high. Furthermore, SRW and SMC of all these items are very low (less than 0.5 and 0.3). Modification indices also do not provide sensible suggestions on how the model could be improved. It indicates that the model is mis-specified with respect to these items. Consequently, these items need to be deleted to improve the model fit.

As GBIR construct is a second order reflective construct derived from seven first order constructs, removing an item does not alter the conceptual domain of the underlying construct (Diamantopoulos and Winklhofer, 2001; Jarvis et al., 2003; Freeze and Raschke, 2007). Thus, GOF statistics were assessed deleting these problematic items one by one. The final version of the re-specified measurement model and its statistics, after deleting these problematic items, are presented below.

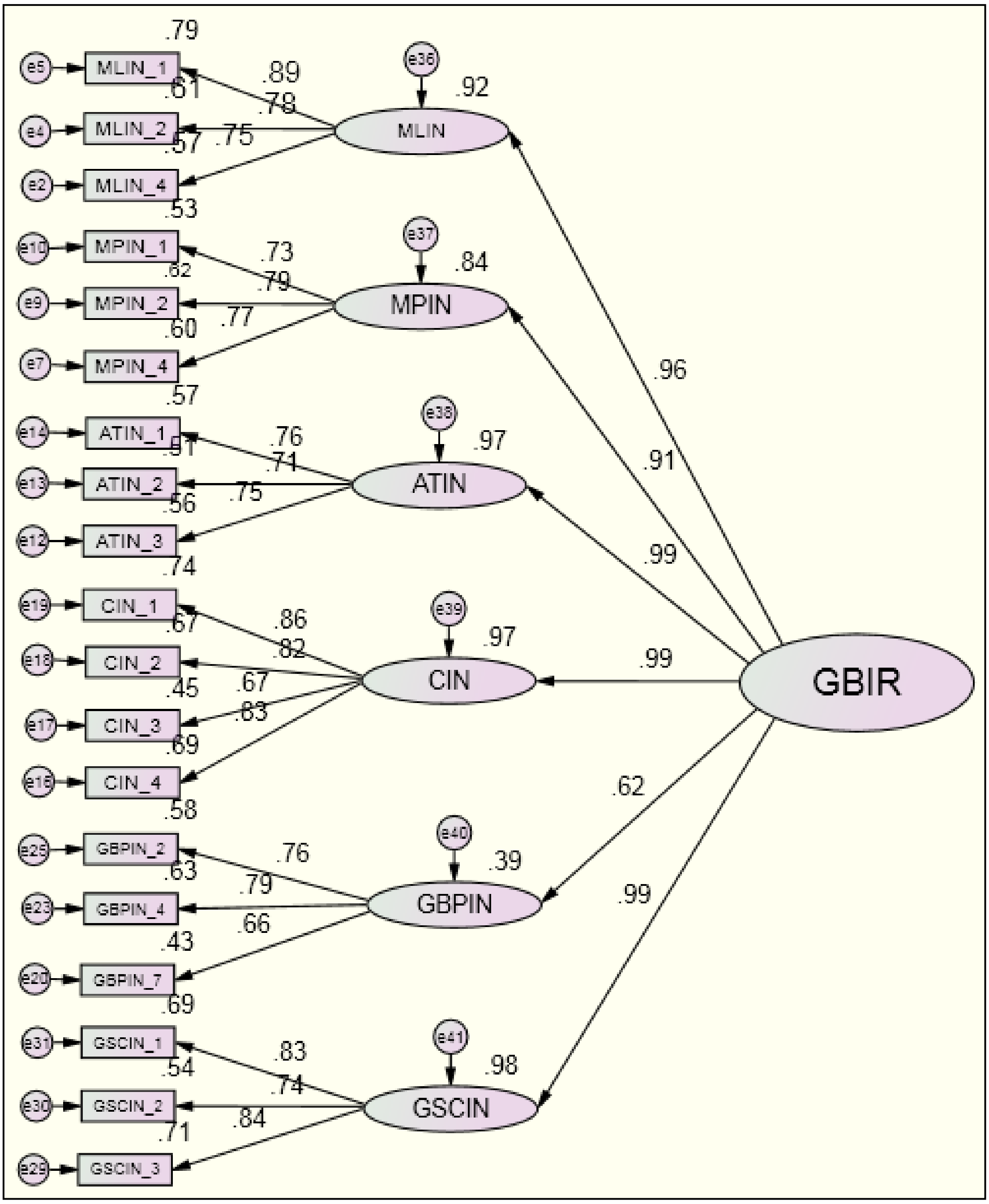


Figure 5-13: Final measurement model of GBIR construct

Model identification		**GOF statistics**			
No. of observed variables	19	Bootstrap p	0.453	CFI	0.990
No. of estimated parameters	76	X^2	170.55	TLI	0.988
DF	146	(X^2/DF)	1.168	RFI	0.924
Model is identified		RMSEA	0.029	AGFI	0.893
		SRMR	0.031	PCLOSE	0.980

With a chi-square of 170.55, 146 DF and a p-value of 0.453, this model now fits well. All GOF statistics are within the recommended thresholds, except AGFI, and are better than the previous model. Furthermore, SRW and SMC of all the items are greater than the accepted ranges (0.5 and 0.3). Therefore, this model has been accepted as a good fitting model. Furthermore, standardised factor loading for all the variables are approximately the same regarding each GBIR indicator variable (0.91 - 0.99), except GBPIN (0.62). This indicates they are parallel measures of GBIR construct (Holmes-Smith, 2011). Squared multiple correlations of all the indicator variables of GBIR are greater than or close to 0.9 except GBPIN (0.39). This indicates that the latent construct (GBIR) accounts for about 90% or more of the variance in each of the indicators and they are good measures of the global business information requirements construct (Holmes-Smith, 2011).

5.5 Measurement model for ERPSC construct

This section discusses the measurement model development of ERP system capabilities (ERPSC) construct. Similar to the global business information requirements construct as discussed in the preceding section, ERP systems capabilities construct consists of seven variables, namely support multi-level information (SMLIN), support multi-purpose information (SMPIN), deliver accurate and timely information (DATIN), deliver consolidated information (DCIN), integrate global business process information (IGBPIN), manage global supply chain information (MGSCIN) and transmit secure information (TSIN). The initial full measurement model of ERP systems capabilities construct and selected statistics are shown in Figure 5.14 and Table 5.26.

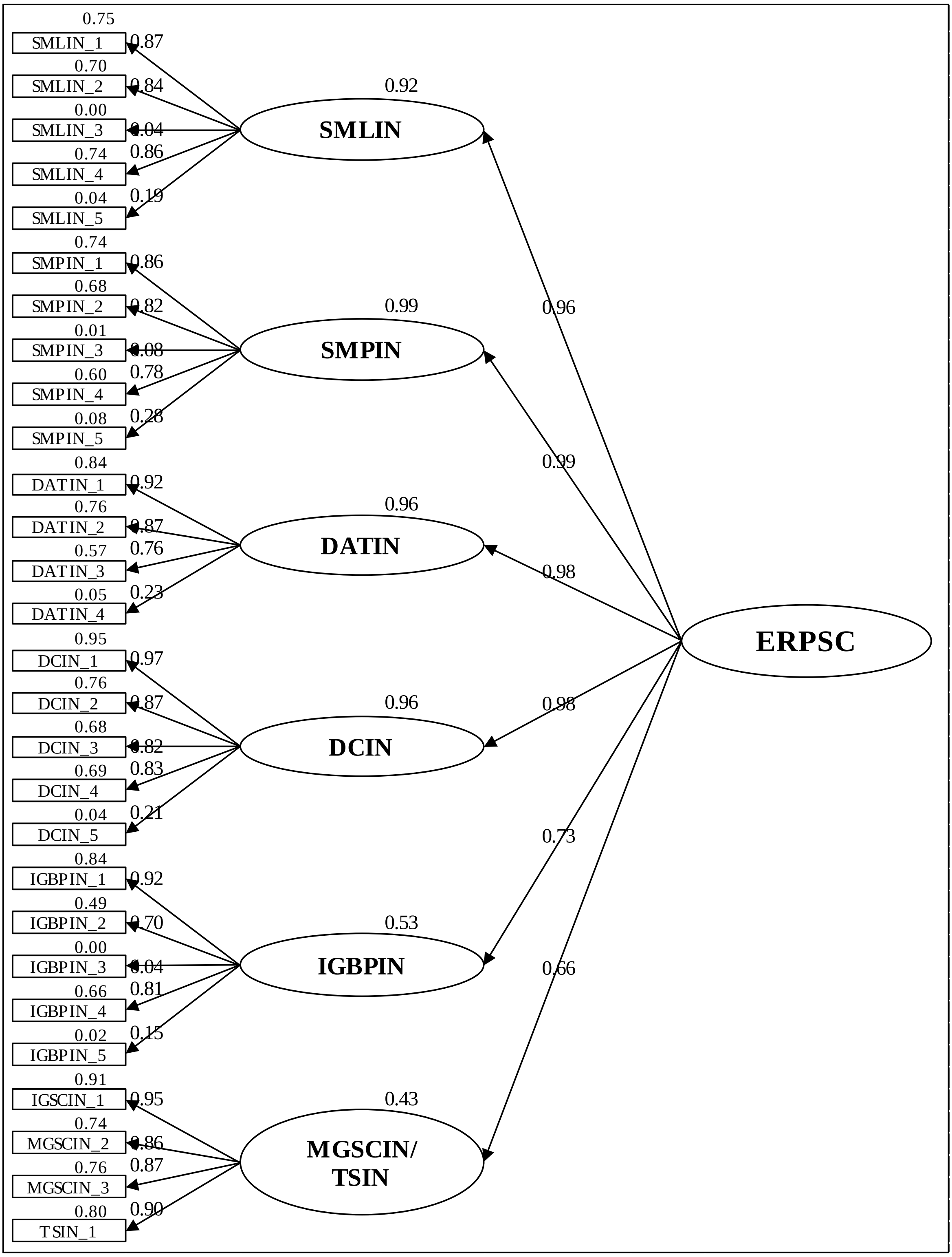


Figure 5-14: Initial measurement model of ERP systems capabilities construct

As shown in Figure 5.14 the initial measurement model of ERP systems capabilities is modelled as a reflective second order construct derived from seven first order reflective variables. ERPSC construct has been developed as a reflective second order construct since it is assumed that the ERP systems capabilities are reflected (manifested) by seven variables as follows: SMLIN, SMPIN, DATIN, DCIN, IGBPIN, MGSCIN and TSIN (Jarvis et al., 2003; Diamantopoulos and Siguaw, 2006). Indicators of this model are interchangeable and share a common theme that is to support global business information requirements. These are the key determining factors of reflective constructs (Jarvis et al., 2003). Therefore, as recommended by Jarvis et al. (2003) and Bollen (2011) this model measures its error terms at the item level.

Table 5-26: Selected statistics of measurement model of ERP systems capabilities construct

Model identification		**GOF statistics**			
No. of observed variables	28	Bootstrap p	0.393	CFI	0.974
No. of estimated parameters	104	X^2	443.05	TLI	0.972
DF	344	(X^2/DF)	1.288	RFI	0.885
Model is identified		RMSEA	0.038	AGFI	0.833
		SRMR	0.046	PCLOSE	0.973

Factor loadings

Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
SMLIN_3	<---	SMLIN	0.038	0.001	0.521	0.602	SRW, SMC & CR are low
SMLIN_5	<---	SMLIN	0.187	0.035	2.559	0.010	SRW & SMC are low
SMPIN_3	<---	SMPIN	0.078	0.006	1.060	0.289	SRW, SMC & CR are low
SMPIN_5	<---	SMPIN	0.272	0.074	3.754	***	SRW & SMC are low
DATIN_4	<---	DATIN	0.220	0.048	3.045	0.002	SRW & SMC are low
DCIN_5	<---	DCIN	0.204	0.041	2.863	0.004	SRW & SMC are low
IGBPIN_3	<---	IGBPIN	0.041	0.002	0.541	0.588	SRW, SMC & CR are low
IGBPIN_5	<---	IGBPIN	0.150	0.022	1.973	0.048	SRW, SMC & CR are low

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

Note: *** p< 0. 001 (two -tailed)

Full measurement model of ERP systems capabilities construct is identified with a chi-square of 443.05, 344 DF and a p-value of 0.393. The other fit measures - normed chi-square = 1.288, RMSEA= 0.038, SRMR= 0.046, CFI= 0.97, TLI= 0.97 and PCLOSE=

0.97 - also indicate that the measurement model of ERPSC is a good fitting model. However, RFI (0.89) and AGFI (0.83) are not within the acceptable thresholds of 0.92 (Hair et al., 2010) and 0.90 (Hair et al., 2010; Schumacker and Lomax, 2010). Furthermore, SRW, SMC and CR of items SLMIN_3, SLMIN_5, SMPIN_3, SMPIN_5, DATIN_4, DCIN_5, IGBPIN_3 and IGBPIN_5 are very low and outside the accepted thresholds of 0.5 (Hair et al., 2010), 0.3 and ±1.96 (Holmes-Smith, 2011). Therefore, full measurement model of ERP systems capabilities was re-examined. As recommended by Hair et al. (2010) and Holmes-Smith (2011), model re-examination was done determining the goodness of fit, validity and reliability of one factor congeneric measurement models.

5.5.1 One factor congeneric measurement model of SMLIN

One factor congeneric measurement model of supporting multi-level information requirements (SMLIN) variable consists of five observed variables. The initial path diagram of this variable is presented in Figure 5.15.

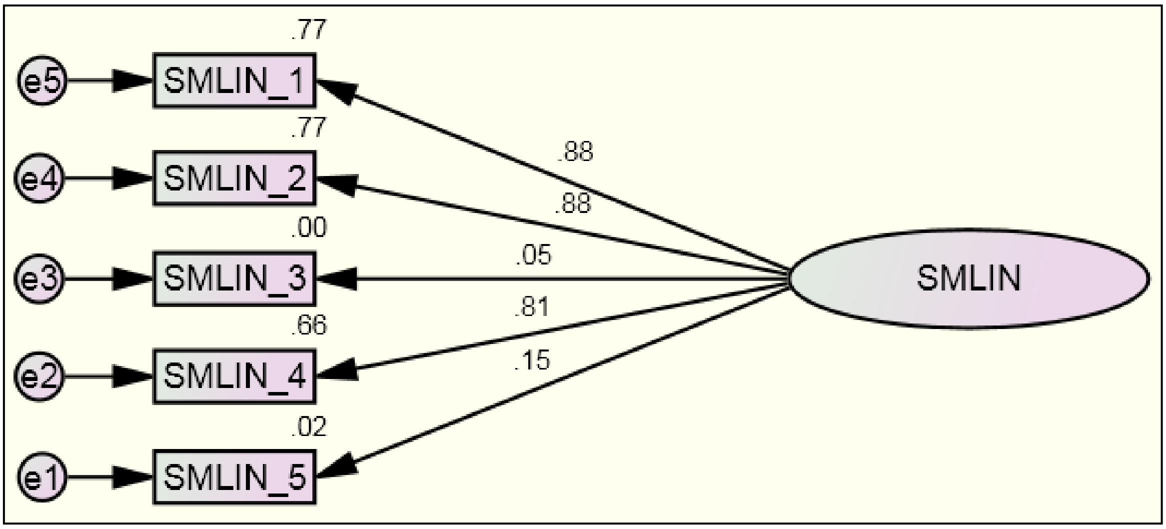


Figure 5-15: Initial path diagram of SMLIN congeneric measurement model

Figure 5.15 shows that SRWs and SMCs of items SMLIN_3 (0.05 and 0.00) and SMLIN_5 (0.15 and 0.02) are below the accepted thresholds of 0.5 and 0.3, indicating that these two items will cause model misfit (Hair et al., 2010; Holmes-Smith, 2011). Selected GOF statistics and model re-specification diagnostic measures shown in Tables 5.27 and 5.28 are also examined to identify the causes of model misfit.

Table 5-27 : GOF statistics of the SMLIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.517	CFI	1
No. of estimated parameters	16	X^2	4.821	TLI	1
DF	5	(X^2/DF)	0.964	RFI	0.973
Model is identified		RMSEA	0.000	AGFI	0.972
		SRMR	0.024	PCLOSE	0.680

One factor congeneric measurement model of SMLIN is identified with a chi-square of 4.821, 5 DF and a p-value of 0.517. All the fit measures are within the accepted ranges, except normed chi-square (0.964). However, model re-specification statistics presented in Table 5.28 indicate that SRWs, SMCs and CRs of SMLIN_3 and SMLIN_5 are well below the accepted thresholds of of 0.5 (Hair et al., 2010), 0.3 and ±1.96 (Holmes-Smith, 2011). Therefore, the model was re-specified by deleting these two items one by one. However, removing both items did not provide satisfactory model fit results and deleting the weakest item (SMLIN_3) only provided the best model fit results. Thus, at this stage this model has been accepted as a well-fitting model. GOF statistics of re-specified model are shown in Table 5.29.

Table 5-28: Model re-specification diagnostic measures of one factor SMLIN congeneric measurement model

Standardized Residual Covariances (SRC)								Modification indices
Item	SMLIN_1	SMLIN_2	SMLIN_3	SMLIN_4	SMLIN_5			
SMLIN_1	0							
SMLIN_2	0.012	0						
SMLIN_3	0.043	0.276	0					
SMLIN_4	0.001	-0.021	-0.549	0				
SMLIN_5	-0.425	-0.092	0.677	0.816	0			
Factor loadings								
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**	
SMLIN_1	<---	SMLIN	0.879	0.773	1.930	0.054		
SMLIN_2	<---	SMLIN	0.878	0.770	1.934	0.053		
SMLIN_3	<---	SMLIN	0.053	0.003	0.660	0.509	SRW, SMC & CR are low	
SMLIN_4	<---	SMLIN	0.814	0.662	1.935	0.053		
SMLIN_5	<---	SMLIN	0.145	0.021	-	-	SRW, SMC & CR are low	
DF: Degree of freedom								
SRW: Standardised regression weight								
CR: Critical ratio								
SMC: Squared multiple correlations								

Table 5-29: GOF statistics of re-specified SMLIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.388	CFI	0.997
No. of estimated parameters	13	X^2	2.937	TLI	0.992
DF	2	(X^2/DF)	1.468	RFI	0.975
Model is identified		RMSEA	0.049	AGFI	0.963
		SRMR	0.021	PCLOSE	0.384

One factor congeneric model of SMLIN is now fitting well with a chi-square of 2.937, 2 DF and a p-value of 0.388. Other fit statistics: normed chi-square = 1.468, RMSEA = 0.049, SRMR = 0.021, CFI = 0.997, TLI = 0.992, RFI = 0.975, AGFI = 0.963 and PCLOSE = 0.384 are also indicating that this model has a good fit.

5.5.2 One factor congeneric measurement model of SMPIN

One factor congeneric measurement model of supporting multi-purpose information requirements (SMPIN) variable consists of five observed variables. The initial path diagram and model fit statistics of this model are shown in Figure 5.16 and Table 5.30.

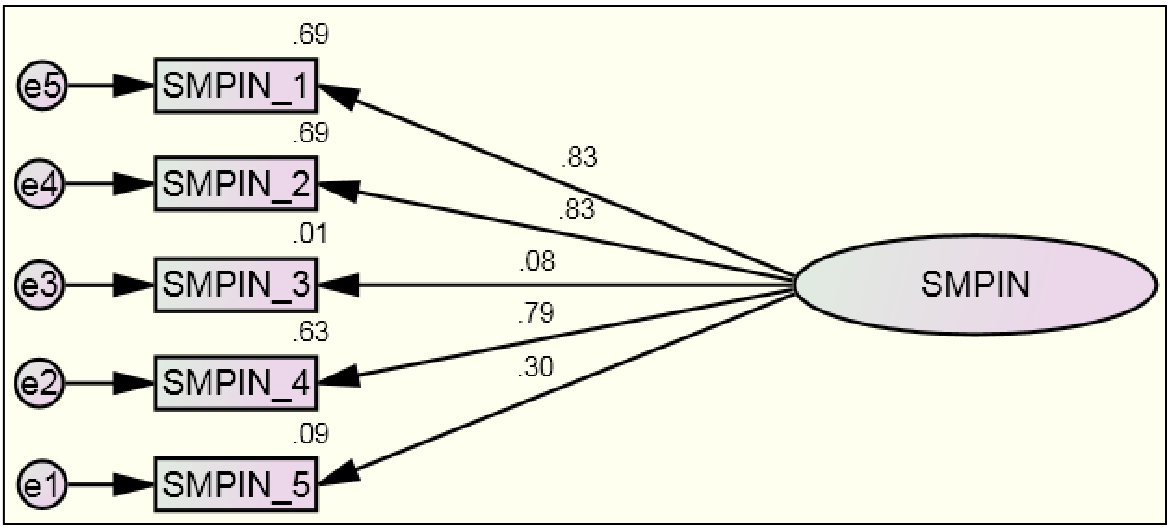


Figure 5-16: Initial path diagram of the SMPIN congeneric measurement model

Table 5-30: GOF statistics of the SMPIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.109	CFI	0.987
No. of estimated parameters	16	X^2	8.585	TLI	0.975
DF	5	(X^2/DF)	1.717	RFI	0.942
Model is identified		RMSEA	0.061	AGFI	0.951
		SRMR	0.039	PCLOSE	0.333

One factor congeneric measurement model of SMPIN is identified with a chi-square of 8.585, 5 DF and a p-value of 0.109. Other model fit statistics: normed chi-square (1.717), RMSEA (0.061), SRMR (0.039), CFI (0.987), TLI (0.975), RFI (0.942), AGFI (0.951) and PCLOSE (0.333) are within the accepted thresholds. However, SRW, SMC and CR of SMPIN_3 (table 5.31) are below the accepted thresholds of 0.5 (Hair et al., 2010), 0.3 and ±1.96 (Holmes-Smith, 2011). Thus, this model has to be re-specified deleting the item SMPIN_3.

Table 5-31: Model re-specification diagnostic measures of one factor SMPIN congeneric measurement model

Standardized Residual Covariances (SRC)						Modification indices				
Item	SMPIN_1	SMPIN_2	SMPIN_3	SMPIN_4	SMPIN_5				M.I.	Par Change
SMPIN_1	0.000									
SMPIN_2	0.073	0.000								
SMPIN_3	0.237	-0.259	0.000							
SMPIN_4	-0.006	-0.079	-0.235	0.000						
SMPIN_5	-0.704	-0.035	1.692	0.858	0.000					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
SMPIN_1	<---	SMPIN	0.831	0.691	3.955	***				
SMPIN_2	<---	SMPIN	0.831	0.690	3.992	***				
SMPIN_3	<---	SMPIN	0.084	0.007	1.063	0.288	SRW, SMC & CR are low			
SMPIN_4	<---	SMPIN	0.795	0.632	4.012	***				
SMPIN_5	<---	SMPIN	0.304	0.092			SRW & SMC are low			
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations										

Note: *** p< 0. 001 (two -tailed)

GOF statistics of one factor congeneric measurement model of SMPIN, after deleting the SMPIN_3 are shown in Table 5.32.

Table 5-32: GOF statistics of re-specified SMPIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.114	CFI	0.991
No. of estimated parameters	13	X^2	4.401	TLI	0.974
DF	2	(X^2/DF)	2.200	RFI	0.954
Model is identified		RMSEA	0.078	AGFI	0.945
		SRMR	0.026	PCLOSE	0.231

With a chi-square of 4.4, 2 DF and a p- value of 0.114, this model now fits well. The other model fit indices: Normed chi-square = 2.2, RMSEA = 0.078, SRMR = 0.026, CFI = 0.99, TLI = 0.97, RFI = 0.95, AGFI = 0.95 and PCLOSE = 0.23 are also within the acceptable thresholds. Thus, this model has been accepted as a good fitting model.

5.5.3 One factor congeneric measurement model of DATIN

Delivering accurate and timely information variable (DATIN) is measured through four items (DATIN_1 to DATIN_4). The path diagram and model fit statistics of DATIN congeneric measurement model are shown in Figure 5.17 and Table 5.33.

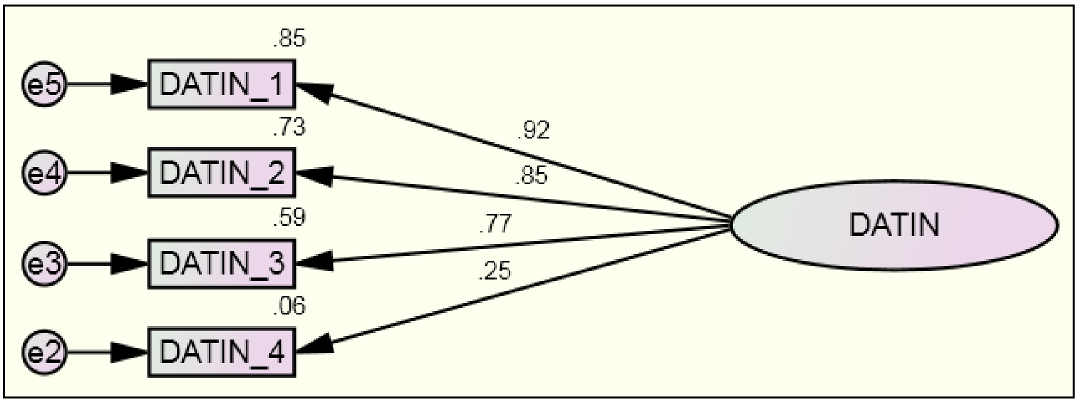


Figure 5-17: Path diagram of the DATIN congeneric measurement model

Table 5-33: GOF statistics of the DATIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.149	CFI	1
No. of estimated parameters	13	X^2	9.347	TLI	1
DF	3	(X^2/DF)	3.116	RFI	0.946
Model is identified		RMSEA	0.104	AGFI	0.923
		SRMR	0.021	PCLOSE	0.092

With a chi-square of 9.347, 3DF and a p-value of 0.149, measurement model of DATIN fits well. All the GOF statistics are within the accepted ranges. However, model re-specification diagnostic measures (Table 5.34) indicate that the SRW and SMC of item DATIN_4 are below the accepted values of 0.5 and 0.3. Therefore, this item may cause model misfit (Hair et al., 2010; Holmes-Smith, 2011). Hence, one factor congeneric measurement model of DATIN has been re-specified deleting item DATIN_4. GOF statistics of the re-specified model are shown in Table 5.35.

Table 5-34: Model re-specification diagnostic measures of DATIN variable

Standardized Residual Covariances (SRC)					Modification indices				
Item	DATIN_1	DATIN_2	DATIN_3	DATIN_4				M.I.	Par Change
DATIN_1	0.000				e3	<-->	DATIN	5.42	-0.081
DATIN_2	0.008	0.000							
DATIN_3	-0.020	0.014	0.000						
DATIN_4	0.058	-0.329	0.356	0.000					
Factor loadings									
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**		
DATIN_1	<---	DATIN	0.921	0.849					
DATIN_2	<---	DATIN	0.853	0.727	14.637	***			
DATIN_3	<---	DATIN	0.770	0.592	12.813	***			
DATIN_4	<---	DATIN	0.253	0.064	3.440	***	SRW & SMC are low		
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations									

Note: *** p< 0. 001 (two -tailed)

Table 5-35: GOF statistics of the re-specified DATIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	3	Bootstrap p	0.09	CFI	0.978
No. of estimated parameters	10	X^2	8.382	TLI	0.933
DF	1	(X^2/DF)	8.382	RFI	0.925
Model is identified		RMSEA	0.195	AGFI	0.836
		SRMR	0.023	PCLOSE	0.014

Re-specified DATIN measurement model is identified with a chi-square of 8.383, 1 DF and a p-value of 0.09. However, deleting the item DATIN_4 did not improve the model fit. As shown in table 5.35, chi-square (8.382), RMSEA (0.195) and AGFI (0.836) of the re-specified model are outside the acceptable ranges. Deletion of the DATIN_4 has worsen the p-value (from 0.149 to 0.09), normed chi-square (from 3.116 to 8.382), RMSEA (from 0.104 to 0.195) and AGFI (from 0.93 to 0.84). Therefore, at this stage it is decided to accept the original model.

5.5.4 One factor congeneric measurement model of DCIN

As shown in Figure 5.18, one factor congeneric measurement model of delivering consolidated information (DCIN) variable consists of five indicators (DCIN_1 to DCIN_5).

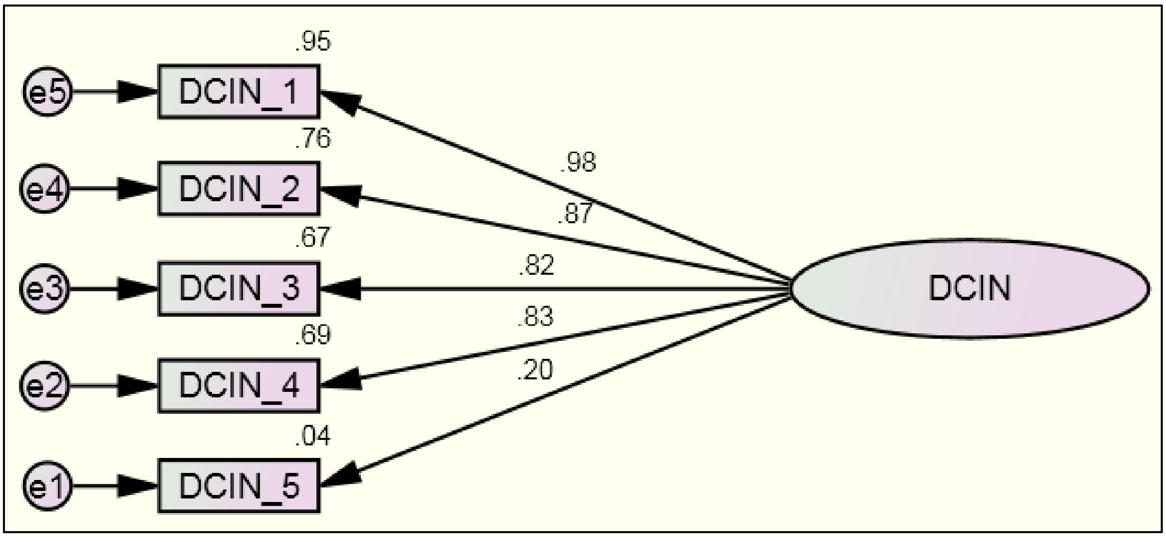


Figure 5-18: Initial path diagram of the DCIN congeneric measurement model.

Table 5-36: GOF statistics of the DCIN congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.473	CFI	0.998
No. of estimated parameters	16	X^2	6.451	TLI	0.996
DF	5	(X^2/DF)	1.290	RFI	0.981
Model is identified		RMSEA	0.039	AGFI	0.960
		SRMR	0.024	PCLOSE	0.515

As shown in Table 5.36, one factor congeneric measurement model of DCIN fits well with a chi-square of 6.451, 5 DF and a p-value of 0.473. Other fit measures: normed chi-square (1.29), RMSEA (0.039), SRMR (0.024), CFI (0.998), TLI (0.996), RFI (0.981), AGFI (0.96) and PCLOSE (0.515) are also within the acceptable ranges. However, SRW and SMC (Table 5.37) of item DCIN_5 suggest that this item is mis-specified (Holmes-

Smith, 2011). Therefore, this model was re-specified by deleting item DCIN_5. The revised statistics after dropping DCIN_5 are presented in Table 5.38.

Table 5-37: Model re-specification statistics

Standardized Residual Covariances (SRC)						**Modification indices**				
Item	DCIN_1	DCIN_2	DCIN_3	DCIN_4	DCIN_5				M.I.	Par Change
DCIN_1	0.000					e1	<-->	e3	4.498	0.066
DCIN_2	0.014	0.000								
DCIN_3	0.011	-0.191	0.000							
DCIN_4	-0.026	0.089	0.101	0.000						
DCIN_5	-0.050	-0.519	1.142	0.064	0.000					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
DCIN_1	<---	DCIN	0.977	0.954						
DCIN_2	<---	DCIN	0.874	0.763	21.408	***				
DCIN_3	<---	DCIN	0.817	0.667	17.771	***				
DCIN_4	<---	DCIN	0.832	0.693	18.456	***				
DCIN_5	<---	DCIN	0.199	0.040	2.776	0.005	SRW & SMC are low			
DF: Degree of freedom										
SRW: Standardised regression weight										
CR: Critical ratio										
SMC: Squared multiple correlations										

Note: *** p< 0. 001 (two -tailed)

Table 5-38: GOF statistics of the re-specified DCIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.652	CFI	1
No. of estimated parameters	13	X^2	1.149	TLI	1
DF	2	(X^2/DF)	0.574	RFI	0.995
Model is identified		RMSEA	0.000	AGFI	0.986
		SRMR	0.007	PCLOSE	0.696

Even though the normed chi-square (0.574) is outside the recommended range (between 1 and 2), this model now fits well. All the other fit statistics: p-value (0.652), RMSEA (0.00), SRMR (0.007), CFI (1.00), TLI (1.00), RFI (0.995), AGFI (0.986) and PCLOSE (0.696) are within the recommended thresholds. Therefore, this model has been accepted as a good fitting model.

5.5.5 One factor congeneric measurement model of IGBPIN

One factor congeneric measurement model of integrating global business process information (IGBPIN) is loaded with five items (IGBPIN_1 to IGBPIN_5). Initial path diagram and GOF statistics for this model are shown in Figure 5.19 and Table 5.39.

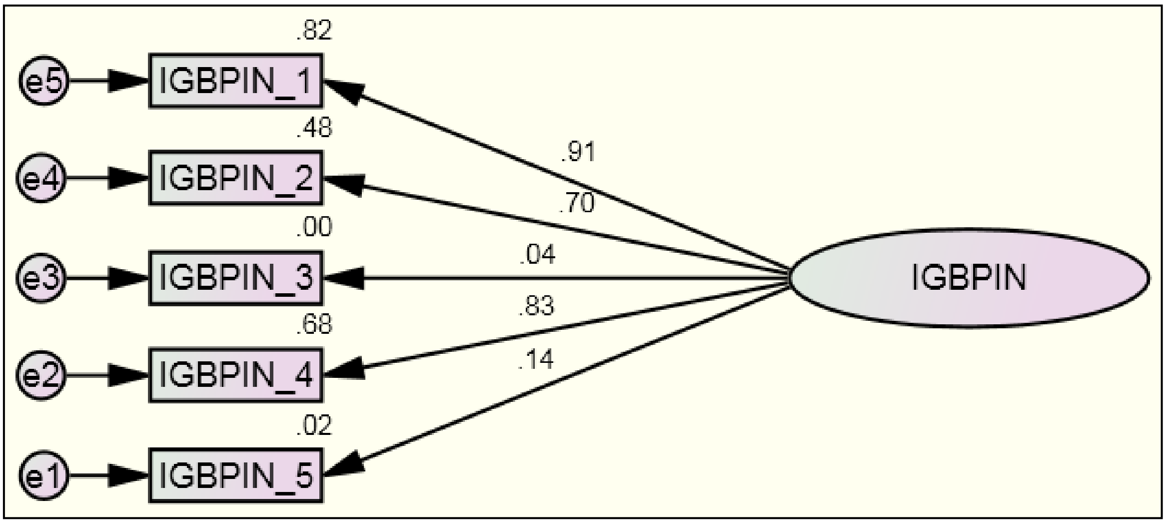


Figure 5-19: Initial path diagram of the IGBPIN congeneric measurement model.

Table 5-39: GOF statistics of the IGBPIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	5	Bootstrap p	0.229	CFI	0.994
No. of estimated parameters	16	X^2	6.693	TLI	0.987
DF	5	(X^2/DF)	1.339	RFI	0.952
Model is identified		RMSEA	0.042	AGFI	0.961
		SRMR	0.031	PCLOSE	0.492

Table 5.39 shows that one factor congeneric measurement model of IGBPIN fits well with a chi-square of 6.693, 5 DF and a p-value of 0.229. However, model re-specification statistics (table 5.40) indicate that this model is mis-specified with items IGBPIN_3 and IGBPIN_5. SRWs and SMCs of both the items are well below the accepted thresholds of 0.5 and 0.3 (Hair et al., 2010, Holmes-Smith, 2011). Hence, this model was re-specified by deleting these two items. However, deleting the both items did not provide satisfactory

fit results. Dropping IGBPIN_3 (worst fitting item) improved the model fit significantly. The GOF statistics of re-specified model (after deleting IGBPIN_ 3) are shown in Table 5.41.

Table 5-40: Model re-specification statistics of the IGBPIN variable

Standardized Residual Covariances (SRC)						**Modification indices**				
Item	IGBPIN_1	IGBPIN_2	IGBPIN_3	IGBPIN_4	IGBPIN_5				M.I.	Par Change
IGBPIN_1	0.000									
IGBPIN_2	0.014	0.000								
IGBPIN_3	0.011	-0.191	0.000							
IGBPIN_4	-0.026	0.089	0.101	0.000						
IGBPIN_5	-0.050	-0.519	1.142	0.064	0.000					
Factor loadings										
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**			
IGBPIN_1	<---	IGBPIN	0.906	0.820						
IGBPIN_2	<---	IGBPIN	0.696	0.484	10.295	***				
IGBPIN_3	<---	IGBPIN	0.038	0.001	0.502	0.616	SRW, SMC & CR are low			
IGBPIN_4	<---	IGBPIN	0.827	0.683	11.808	***				
IGBPIN_5	<---	IGBPIN	0.138	0.019	1.787	0.074	SRW, SMC & CR are low			
DF: Degree of freedom										
SRW: Standardised regression weight										
CR: Critical ratio										
SMC: Squared multiple correlations										

Note: *** p< 0. 001 (two -tailed)

Table 5-41: GOF statistics of the re-specified IGBPIN measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.159	CFI	0.995
No. of estimated parameters	13	X^2	3.465	TLI	0.984
DF	2	(X^2/DF)	1.732	RFI	0.962
Model is identified		RMSEA	0.061	AGFI	0.956
		SRMR	0.022	PCLOSE	0.320

GOF statistics shown in Table 5.41 indicate that the re-specified IGBPIN model achieves a good fit: normed chi-square (1.732), RMSEA (0.061), SRMR (0.022), CFI (0.995), TLI (0.984), RFI (0.962), AGFI (0.956) and PCLOSE (0.320) fall within the acceptable ranges. Thus, this model has been accepted as a good fitting model.

5.5.6 One factor congeneric measurement model of MGSCIN

Initial path diagram and selected statistical results of managing global supply chain information (MGSCIN) are shown in Figure 5.20 and Table 5.42.

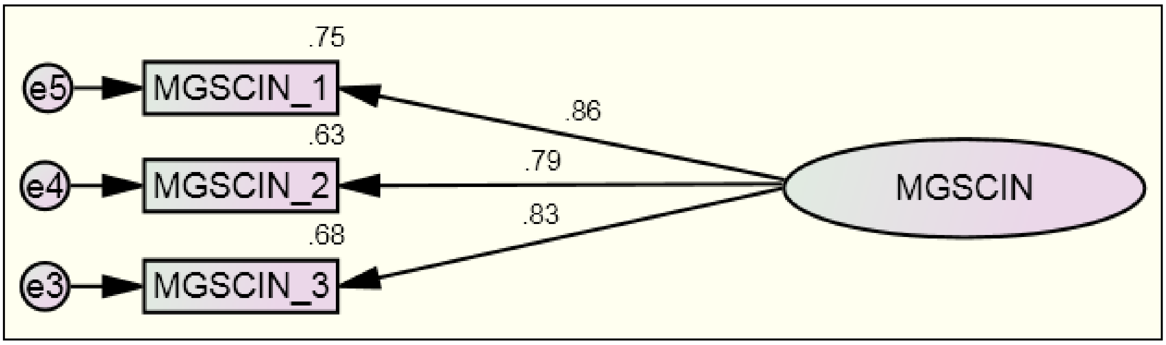


Figure 5-20: Initial path diagram of the MGSCIN congeneric measurement model.

The standardised factor loadings of each items are displayed above the arrows pointng from the latent variable (MGSCIN) towards the indicator variables. The SMCs are shown above the indicator variables.

Table 5-42: Selected statistical results of the MGSCIN congeneric measurement model

Model identification				**GOF statistics**				
No. of observed variables			3	Bootstrap p		0.129	CFI	0.997
No. of estimated parameters			10	X^2		1.836	TLI	0.991
DF			1	(X^2/DF)		1.836	RFI	0.981
Model is identified				RMSEA		0.065	AGFI	0.963
				SRMR		0.012	PCLOSE	0.276
Factor loadings								
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**	
MGSCIN_1	<---	MGSCIN	0.864	0.746				
MGSCIN_2	<---	MGSCIN	0.792	0.627	13.436	***		
MGSCIN_3	<---	MGSCIN	0.826	0.682				
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations								

Note: *** p< 0. 001 (two -tailed)

Statistical results indicate that this model achieves an acceptable fit with a chi-square of 1.836, 1 DF and a p-value of 0.129. All the other fit statistics: normed chi-square (1.836), RMSEA (0.065), SRMR (0.012), CFI (0.997), TLI (0.991), RFI (0.981), AGFI (0.963) and PCLOSE (0.276) also fall within the recommended thresholds. Therefore, this model has been accepted as a good fitting model.

5.5.7 One factor congeneric measurement model of TSIN

Congeneric measurement model of transmitting secure information (TSIN) has only one observed variable (item). Therefore, this variable was dropped from the analysis because SEM cannot analyse a single item factor (Brown, 2006; Dawn, 2010).

5.5.8 Final measurement model of ERPSC construct

Having established a satisfactory fit in one factor congeneric models, the next step is to determine the model fit of the final measurement model of ERP systems capabilities. The path diagram and the selected statistical results of the final measurement model of ERP systems capabilities construct are shown in Figure 5.21 and Table 5.43.

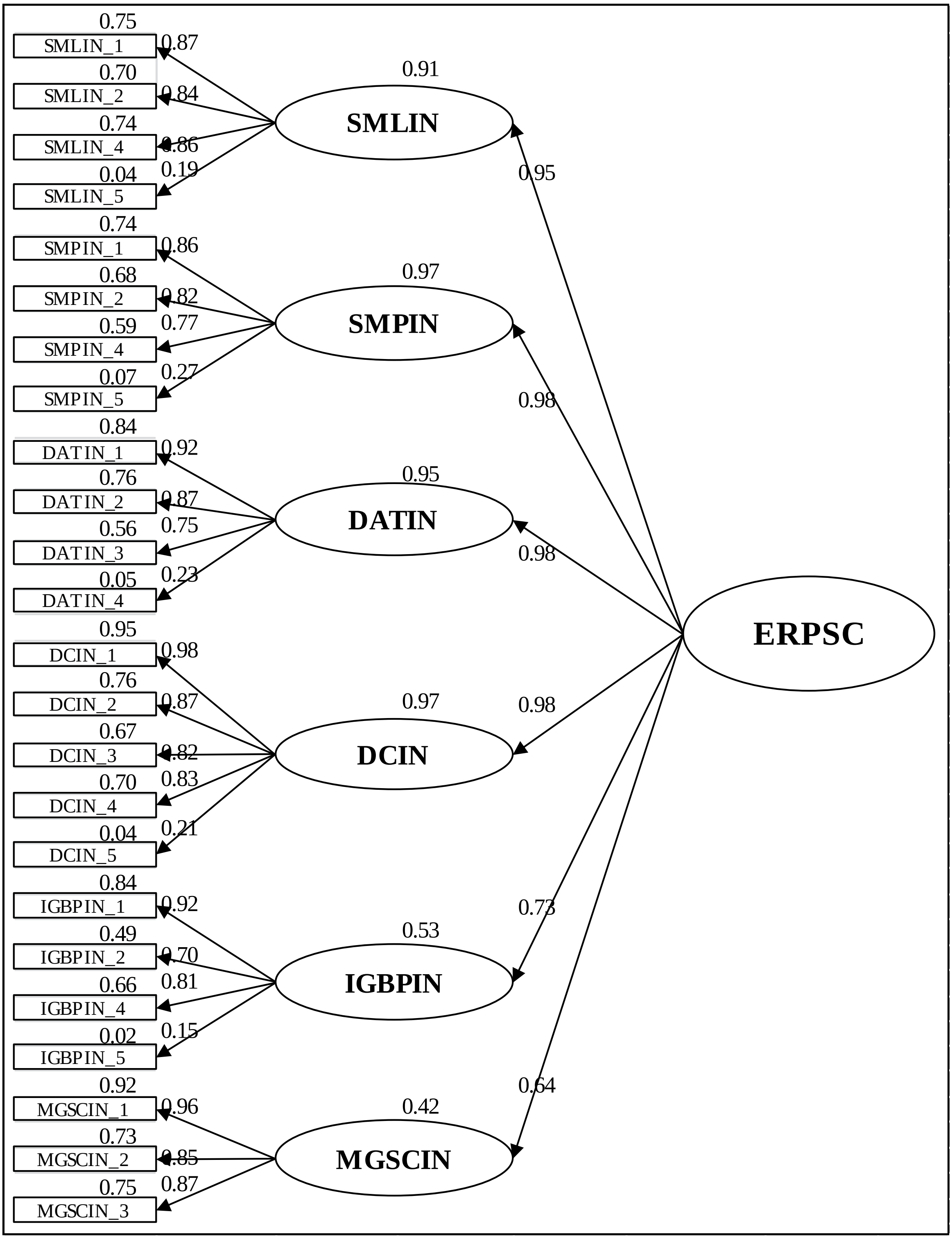


Figure 5-21: Path diagram of the measurement model of ERP systems capabilities

The standardised factor loadings are displayed above the arrows pointing from variables towards the items and from the construct (ERPSC) towards the variables. SMCs are shown above the items and variables.

Table 5-43: Selected statistical results of the measurement model of ERPSC.

Model identification				**GOF statistics**			
No. of observed variables			24	Bootstrap p	0.005	CFI	0.917
No. of estimated parameters			92	X^2	550.40	TLI	0.907
DF			247	(X^2/DF)	2.228	RFI	0.843
Model is identified				RMSEA	0.079	AGFI	0.813
				SRMR	0.089	PCLOSE	0.000
Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
IGBPIN_5	<---	IGBPIN	0.149	0.022	1.963	0.050	SRW & SMC are low
SMLIN_5	<---	SMLIN	0.188	0.035	2.909	0.004	SRW & SMC are low
DCIN_5	<---	DCIN	0.207	0.043	2.564	0.010	SRW & SMC are low
DATIN_4	<---	DATIN	0.225	0.051	3.124	0.002	SRW & SMC are low
SMPIN_5	<---	SMPIN	0.272	0.074	3.762	***	SRW & SMC are low
DF: Degree of freedom							
SRW: Standardised regression weight							
CR: Critical ratio							
SMC: Squared multiple correlations							

Note: *** p< 0. 001 (two -tailed)

Final measurement model of ERP systems capabilities is identified with a chi-square of 550, 247 DF and a p-value of 0.005. Model fit indices indicate that this model does not have a good fit. P-value (0.005) is less than the recommended threshold of 0.05, Normed chi-square (2.2) is outside the recommended range of 1 < (X2/DF) <2. CFI (0.92) and TLI (0.91) are slightly lower than the recommended value of 0.92. AGFI (0.81) and PCLOSE (0.00) are also lower than the recommended values of 0.95 and 0.05. Furthermore, SRWs and SMCs of items IGBPIN_5, SMLIN_5, DCIN_5, DATIN_4 and SMPIN_5 are very low, indicating that these items are mis-specified. Therefore, the final measurement model of ERP systems capabilities was re-specified by deleting these items. The path diagram of the re-specified measurement model and its statistical results are presented in Figure 5.22 and Table 5.44.

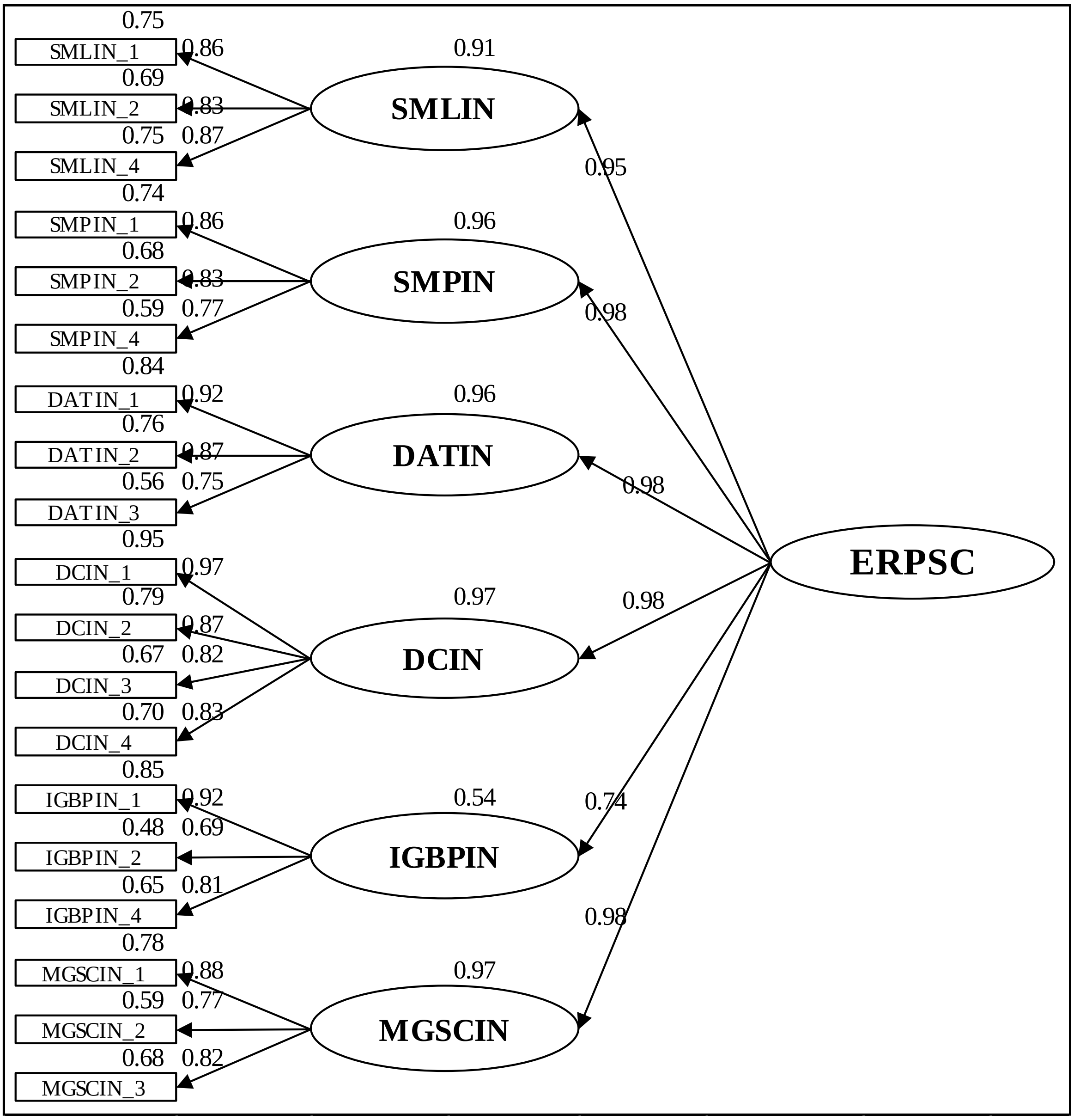


Figure 5-22: Path diagram of the re-specified measurement model of ERPSC

Table 5-44: GOF statistics of the re-specified measurement model of ERPSC

Model identification		**GOF statistics**			
No. of observed variables	20	Bootstrap p	0.423	CFI	0.982
No. of estimated parameters	79	X^2	232	TLI	0.979
DF	164	(X^2/DF)	1.415	RFI	0.933
Model is identified		RMSEA	0.046	AGFI	0.859
		SRMR	0.031	PCLOSE	0.671

With a chi-square of 232, 164 DF and a p-value of 0.423, final measurement model of ERPSC now fits well. RMSEA (0.046) and SRMR (0.031) are well below the recommended thresholds of 0.08 and 0.09 (Hair et al., 2010). CFI (0.98), TLI (0.98) and RFI (0.93) are well above the recommended threshold of 0.92 (Hair et al., 2010; Schumacker and Lomax, 2010). PCLOSE (0.67) is well above the recommended value of 0.05 (Hair et al., 2010; Holmes-Smith, 2011). SRW and SMC of all the variables are also greater than or close to the accepted values of 0.5 and 0.3 (Hair et al., 2010; Holmes-Smith, 2011). These results suggest that the final measurement model of ERPSC is a good fitting model.

Furthermore, standardised factor loadings of all the variables are approximately the same for all indicator variables (0.95 - 0.98), except IGBPIN variable (0.74). This suggests that they are parallel measures of ERPSC construct (Holmes-Smith, 2011). Squared multiple correlations of all the indicator variables are greater than 0.9 except IGBPIN (0.54). This indicates that the latent construct (ERPSC) accounts for about 90% or more of the variance in each of the indicators and they are good measures of the ERPSC construct (Holmes-Smith, 2011). The following section discusses the reliability and validity of the final measurement model of ERP systems capabilities construct.

5.5.9 Reliability and validity of ERPSC construct

To validate the measurement model of ERP systems capabilities construct, reliability, convergent validity and discriminant validity were assessed. Reliability coefficient (Cronbach’s alpha), Hancock and Mueller’s coefficient H and AVE were used to measure the reliability of the variables. Item reliability was measured using SMC. Convergent validity was measured using SFL, AVE and Cronbach’s alpha. Chi-square difference test was used to measure discriminant validity of the model. The results of the reliability and convergent validity tests are shown in Table 5.45 and the results of discriminant validity are presented in Tables 5.46, 5.47 and 5.48.

Table 5-45: Reliability and convergent validity of the final measurement model of ERPSC

Item	Variable	Reliability				Convergent validity			Remarks
		Cronbach's alpha	H	AVE	SMC	SFL	AVE	Cronbach's alpha	
SMLIN_1	**Support multi-level information**	0.91	0.90	0.73	0.77	0.88	0.73	0.91	Reliability & convergent validity hold
SMLIN_2					0.77	0.88			Reliability & convergent validity hold
SMLIN_4					0.67	0.82			Reliability & convergent validity hold
SMPIN_1	**Support multi-purpose information**	0.89	0.86	0.67	0.71	0.84	0.67	0.89	Reliability & convergent validity hold
SMPIN_2					0.69	0.83			Reliability & convergent validity hold
SMPIN_4					0.62	0.78			Reliability & convergent validity hold
DATIN_1	**Deliver accurate timely information**	0.91	0.89	0.73	0.77	0.88	0.73	0.91	Reliability & convergent validity hold
DATIN_2					0.75	0.87			Reliability & convergent validity hold
DATIN_3					0.67	0.82			Reliability & convergent validity hold
DCIN_1	**Deliver consolidated information**	0.97	0.97	0.77	0.96	0.98	0.77	0.97	Reliability & convergent validity hold
DCIN_2					0.76	0.87			Reliability & convergent validity hold
DCIN_3					0.67	0.82			Reliability & convergent validity hold
DCIN_4					0.69	0.83			Reliability & convergent validity hold
IGBPIN_1	**Integrate global business process information**	0.93	0.88	0.66	0.82	0.91	0.66	0.93	Reliability & convergent validity hold
IGBPIN_2					0.48	0.70			Reliability & convergent validity hold
IGBPIN_3					0.69	0.83			Reliability & convergent validity hold
MGSCIN_1	**Manage global supply chain information**	0.84	0.91	0.69	0.80	0.90	0.69	0.84	Reliability & convergent validity hold
MGSCIN_2					0.61	0.78			Reliability & convergent validity hold
MGSCIN_3					0.63	0.80			Reliability & convergent validity hold
MGSCIN_4					0.70	0.83			Reliability & convergent validity hold

As shown in Table 5.45, Cronbach's alpha values of all the variables are greater than the recommended threshold of 0.70 indicating a high internal consistency (Su and Yang, 2010). Co-efficient H, AVE and SFL of all the variables are also greater than the recommended thresholds of 0.7, 0.5 and 0.5. These results confirm that the measurement model of ERP systems capabilities construct has high reliability and convergent validity (Hair et al., 2010; Holmes-Smith, 2011).

5.5.10 Discriminant validity of the measurement model of ERPSC

Table 5-46: Chi-square of unconstrained and constrained models

Variable	SMLIN		SMPIN		DATIN		DCIN		IGBPIN		MGSCIN	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM
SMLIN	-	-										
SMPIN	12.32	42.74	-	-								
DATIN	20.00	55.58	8.66	42.88	-	-						
DCIN	35.68	62.10	10.04	33.29	18.62	48.22	-	-				
IGBPIN	17.96	68.41	6.62	55.73	12.92	64.33	10.91	49.62	-	-		
MGSCIN	25.27	51.58	13.31	40.94	10.49	39.72	11.77	31.78	9.65	49.31	-	-
UCM - Unconstrained model												
CM - Constrained model												

Table 5-47: DF of unconstrained and constrained models

Variable	SMLIN		SMPIN		DATIN		DCIN		IGBPIN		MGSCIN	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM	UCM	CM
SMLIN	-	-										
SMPIN	8.00	9.00	-	-								
DATIN	8.00	9.00	8.00	9.00	-	-						
DCIN	13.00	14.00	13.00	14.00	13.00	14.00	-	-				
IGBPIN	8.00	9.00	8.00	9.00	8.00	9.00	13.00	14.00	-	-		
MGSCIN	13.00	14.00	13.00	14.00	13.00	14.00	19.00	20.00	13.00	14.00	-	-
UCM - Unconstrained model												
CM - Constrained model												

Table 5-48: Chi-square difference test

Variable	SMLIN			SMPIN			DATIN			DCIN			IGBPIN			Remarks
	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	Δ X2	Δ DF	P	
SMLIN	-	-														Discriminant validity holds
SMPIN	30.42	1.00	0.00	-	-											Discriminant validity holds
DATIN	35.58	1.00	0.00	34.22	1.00	0.00	-	-								Discriminant validity holds
DCIN	26.43	1.00	0.00	23.25	1.00	0.00	29.60	1.00	0.00	-	-					Discriminant validity holds
IGBPIN	50.45	1.00	0.00	49.11	1.00	0.00	51.42	1.00	0.00	38.71	1.00	0.00	-	-		Discriminant validity holds
MGSCIN	26.31	1.00	0.00	27.63	1.00	0.00	29.23	1.00	0.00	20.02	1.00	0.00	39.66	1.00	0.00	Discriminant validity holds
Δ X2	Difference in chi-square															
Δ DF	Difference in degree of freedom															
P	Probability															

Discriminant validity of the measurement model of ERP systems capabilities was established with chi-square difference test. Table 5.46 shows that the chi-square statistics of the unconstrained models are significantly lower than the chi-square statistics of constrained models. Furthermore, the p- values of all the variables reach 0.000 (Table

5.48). Thus, the measurement model of ERP systems capabilities construct achieves adequate discriminant validity.

5.6 Measurement model for GBPER construct

The final construct of the proposed research model is global business performance (GBPER). Global business performance has been measured using 14 different items that have been grouped under the balanced scorecard (BSC) performance measures developed by Kaplan and Norton (1998). The initial measurement model of global business performance and its GOF statistics are shown in Figure 5.23 and Table 5.49.

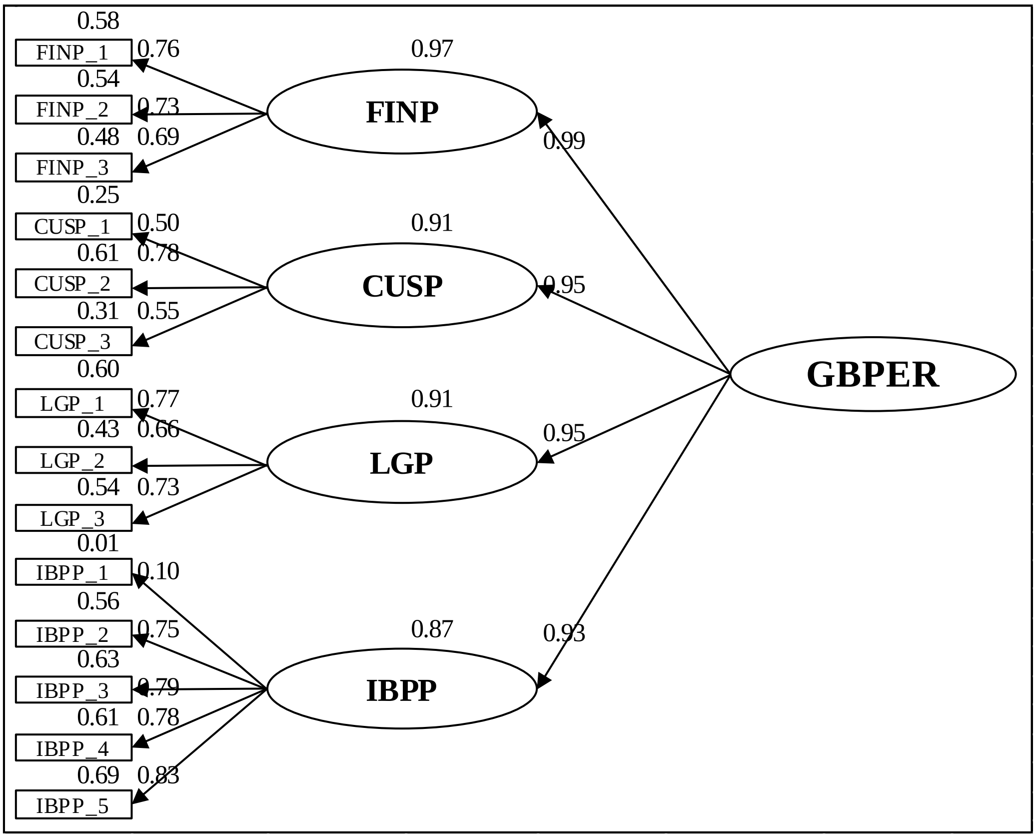


Figure 5-23: Initial measurement model of global business performance

The initial measurement model of global business performance is modelled as a reflective second order construct derived from four first order reflective variables, financial, customer, learning and growth and internal business process performance. GBPER construct has been drawn as a reflective construct as it assumes that the performance outcomes achieved from the co-alignment of global business information requirements and ERP systems capabilities is reflected (manifested) by four variables (Jarvis et al., 2003; Diamantopoulos and Siguaw, 2006). Indicators of this model are interchangeable and share a common theme, global business performance outcomes, which are the key determining factors of a reflective construct (Jarvis et al., 2003). Consequently as recommended by Jarvis et al. (2003) and Bollen (2011) this model measures its error terms at the item level.

Table 5-49: GOF statistics of the measurement model of global business performance

Model identification		**GOF statistics**			
No. of observed variables	14	Bootstrap p	0.612	CFI	0.998
No. of estimated parameters	55	X^2	75.408	TLI	0.998
DF	73	(X^2/DF)	1.033	RFI	0.930
Model is identified		RMSEA	0.013	AGFI	0.925
		SRMR	0.034	PCLOSE	0.983

With a chi-square 75, 73 DF and a p-value of 0.612, measurement model of global business performance fits well. All the GOF statistics are within the recommended thresholds except AGFI (0.93). However, SRW (0.10) and SMC (0.01) for item IBPP_1 are well below the recommended thresholds of 0.5 and 0.3. Hence, one-factor congeneric measurements models were examined to establish the goodness of fit, validity and reliability of GBPER construct.

5.6.1 One factor congeneric measurement model of FINP

One factor congeneric measurement model of financial performance (FINP) consists of three observed variables, increased return on investment, increased sales revenue and reduced operational costs. The initial path diagram and GOF statistics for this model are shown in Figure 5.24 and Table 5.50.

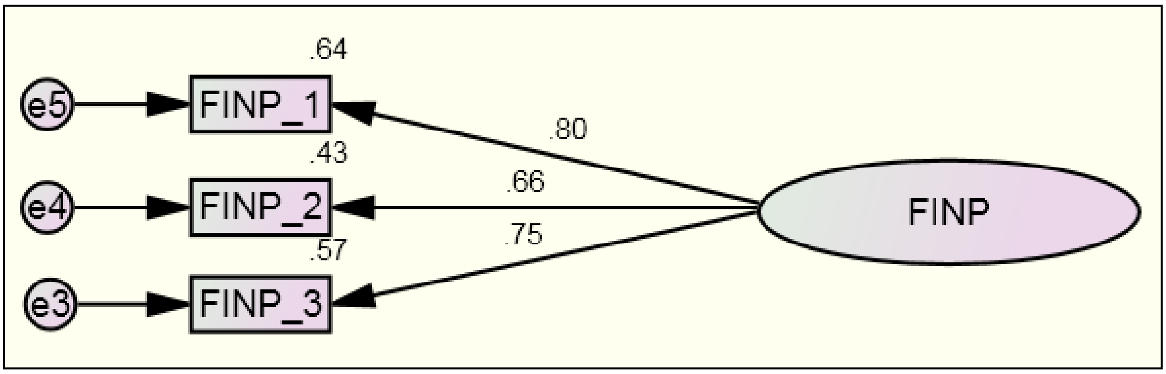


Figure 5-24: Initial path diagram of the FINP congeneric measurement model.

Table 5-50: Selected statistical results of FINP congeneric measurement model

Model identification		**GOF statistics**			
No. of observed variables	3	Bootstrap p	0.955	CFI	1
No. of estimated parameters	10	X^2	0.274	TLI	1
DF	1	(X^2/DF)	0.274	RFI	1
Model is identified		RMSEA	0.000	AGFI	1
		SRMR	0.008	PCLOSE	0.680

Factor loadings

Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
FINP_1	<---	FINP	0.796	0.634			
FINP_2	<---	FINP	0.637	0.406			
FINP_3	<---	FINP	0.766	0.587	8.992	***	

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

Note: *** p< 0. 001 (two -tailed)

The above fit statistics indicate that this model is a good fitting model. All the fit statistics are within the acceptable ranges except normed chi-square (0.274). Modification indices do not provide any suggestion for improving the model fit. Furthermore, SEM requires each variable to have at least three indicator variables (Dawn, 2010). Therefore, this model has been accepted as a good fitting model even though the normed chi-square (0.274) is outside the accepted threshold between 1 and 2.

5.6.2 One factor congeneric measurement model of CUSP

One factor congeneric measurement model of customer performance (CUSP) variable contains three items, enhanced company image/reputation, increased customer satisfaction and improved supplier relationship management. The initial path diagram and GOF statistics are presented in Figure 5.25 and Table 5.51.

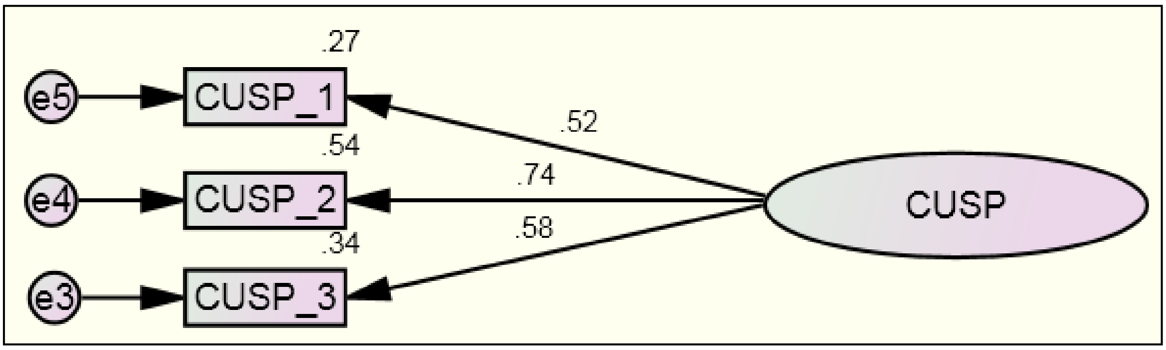


Figure 5-25: Initial path diagram of the CUSP congeneric measurement model.

Table 5-51: Selected statistical results of the CUSP congeneric measurement model

Model identification				**GOF statistics**			
No. of observed variables			3	Bootstrap p	0.308	CFI	0.998
No. of estimated parameters			10	X^2	1.127	TLI	0.995
DF			1	(X^2/DF)	1.127	RFI	0.956
Model is identified				RMSEA	0.025	AGFI	0.977
				SRMR	0.022	PCLOSE	0.397
Factor loadings							
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
CUSP_1	<---	CUSP	0.522	0.273			
CUSP_2	<---	CUSP	0.735	0.540	4.872	***	
CUSP_3	<---	CUSP	0.582	0.338			
DF: Degree of freedom							
SRW: Standardised regression weight							
CR: Critical ratio							
SMC: Squared multiple correlations							

Note: *** p< 0. 001 (two -tailed)

As shown in Table 5.51, one factor congeneric measurement model of CUSP is identified with a chi-square value of 1.127, 1 DF and a p-value of 0.308. Other fit indices: normed chi-square (1.127), RMSEA (0.025), SRMR (0.022), CFI (0.998), TLI (0.995), RFI (0.956), AGFI (0.977) and PCLOSE (0.397) are within the recommended thresholds. Therefore, this model is acceptable.

5.6.3 One factor congeneric measurement model of LGP

One factor congeneric measurement model of learning and growth performance (LGP) consists of three items, enhanced market share, improved innovation capabilities and enhanced employee satisfaction. Initial path diagram and selected statistical results are shown in Figure 5.26 and Table 5.52.

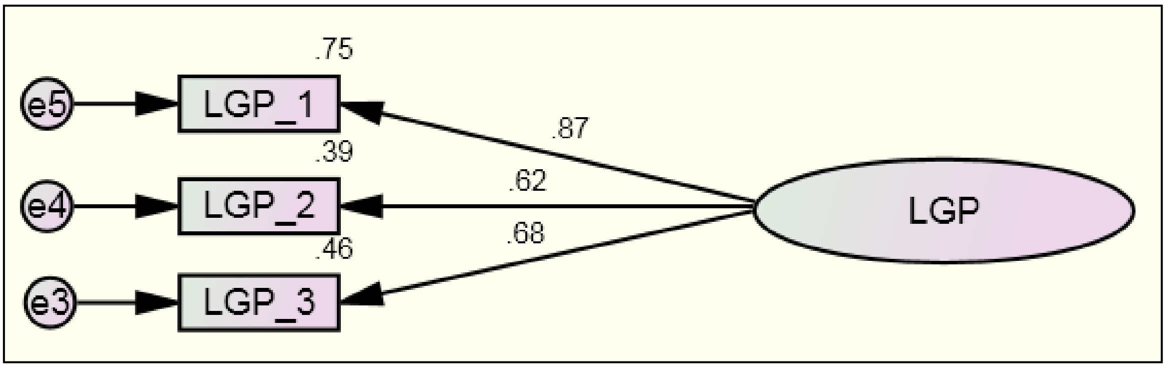


Figure 5-26: Initial path diagram of the LGP congeneric measurement model.

Table 5-52: Selected statistical results of the LGP congeneric measurement model

Model identification				**GOF statistics**				
No. of observed variables			3	Bootstrap p		0.119	CFI	0.996
No. of estimated parameters			10	X^2		1.663	TLI	0.987
DF			1	(X^2/DF)		1.663	RFI	0.967
Model is identified				RMSEA		0.058	AGFI	0.966
				SRMR		0.020	PCLOSE	0.301
Factor loadings								
Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**	
LGP_1	<---	LGP	0.866	0.751	7.845	***		
LGP_2	<---	LGP	0.622	0.387				
LGP_3	<---	LGP	0.675	0.456				
DF: Degree of freedom SRW: Standardised regression weight CR: Critical ratio SMC: Squared multiple correlations								

Note: *** p< 0. 001 (two -tailed)

The model fit statistics indicate that the one factor congeneric measurement model of LGP fits well with a chi-square of 1.663, 1 DF and a p-value of 0.119. Other fit indices: RMSEA (0.058), SRMR (0.020), CFI (0.996), TLI (0.987), RFI (0.967), AGFI (0.966), PCLOSE (0.301), SRWs, SMCs and CRs, are also within the accepted thresholds. Hence, this model is accepted as a good fitting model.

5.6.4 One factor congeneric measurement model of IBPP

The last variable of the global business performance construct is internal business process performance (IBPP). It comprises five items - better inventory management, reduction in waste, improved quality of products and services, improved organizational productivity and improved operational efficiency (IBPP_1 to IBPP_5). Initial path diagram and GOF statistics of IBPP variable are depicted in Figure 5.27 and Table 5.53.

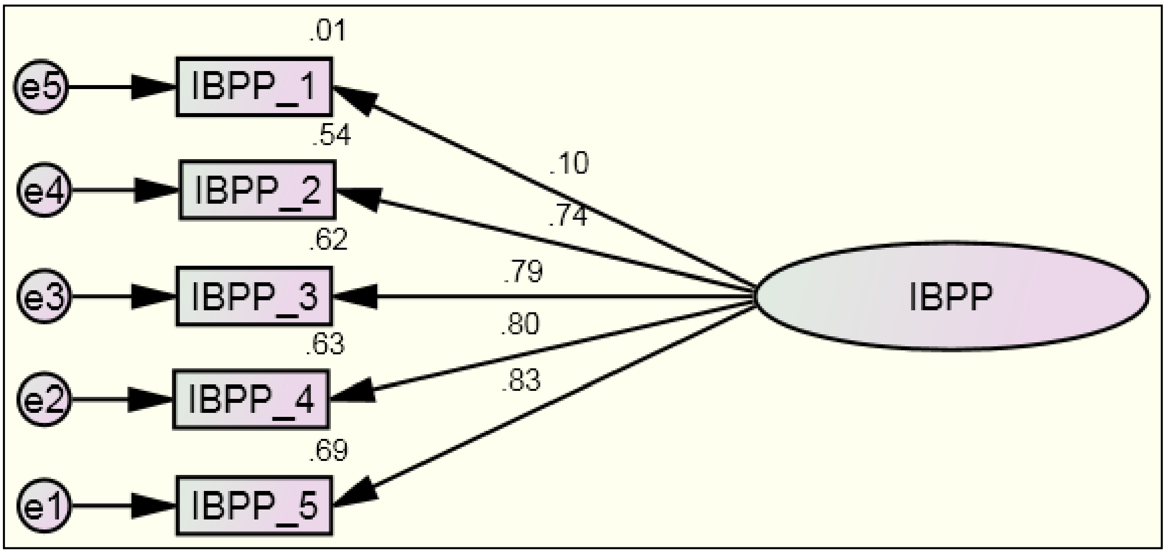


Figure 5-27: Initial path diagram of the IBPP congeneric measurement model.

Table 5-53: Selected statistical results of the IBPP congeneric measurement model

Model identification			**GOF statistics**			
No. of observed variables		5	Bootstrap p	0.119	CFI	1
No. of estimated parameters		16	X^2	2.732	TLI	1
DF		5	(X^2/DF)	0.546	RFI	0.985
Model is identified			RMSEA	0.000	AGFI	0.984
			SRMR	0.020	PCLOSE	0.884

Factor loadings

Item		**Variable**	**SRW**	**SMC**	**C.R.**	**P**	**Comment**
IBPP_1	<---	IBPP	0.103	0.011	1.346	0.178	SRW, SMC & CR are low
IBPP_2	<---	IBPP	0.737	0.544	10.651	***	
IBPP_3	<---	IBPP	0.786	0.617	11.684	***	
IBPP_4	<---	IBPP	0.796	0.633	11.957	***	
IBPP_5	<---	IBPP	0.830	0.689			

DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations

Note: *** p< 0. 001 (two -tailed)

This model is identified with a chi-square of 2.732, 5 DF and a p-value of 0.119. The other fit statistics: RMSEA (0.00), SRMR (0.02), CFI (1), TLI (1), RFI (0.98), AGFI (0.98) and PCLOSE (0.88) also indicate a good fit. However, normed chi-square (0.546) is outside the accepted threshold of $1 > (X^2/DF) < 2$ (Hair et al., 2010; Holmes-Smith, 2011). Furthermore, SRW, SMC and CR of IBPP_1 are very low and outside the accepted thresholds of 0.5, 0.3 and ± 1.96, indicating that the item IBPP_1 is mis-sepecified. Therefore, one factor congeneric measurement model of IBPP was re-specified by deleting IBPP_1. Re-specified GOF statistics are shown in Table 5.54.

Table 5-54: GOF statistics of the re-specified IBPP measurement model

Model identification		**GOF statistics**			
No. of observed variables	4	Bootstrap p	0.254	CFI	1
No. of estimated parameters	13	X^2	2.095	TLI	0.999
DF	2	(X^2/DF)	1.048	RFI	0.983
Model is identified		RMSEA	0.016	AGFI	0.974
		SRMR	0.012	PCLOSE	0.510

With a chi-square of 2.095, 2 DF and a p-value of 0.254 one factor congeneric measurement model of IBPP now fits well. Other model fit statistics, specifically normed chi-square (1.048), RMSEA (0.016), SRMR (0.012), CFI (1.0), TLI (0.999), RFI (0.983), AGFI (0.974) and PCLOSE (0.51) also indicate a good fit.

5.6.5 Final measurement model of GBPER construct

Having established satisfactory one-factor congeneric measurement models, the validity of the final measurement model of global business performance (GBPER) construct was determined. Validation and re-specification of one factor congeneric measurement models was deleted only one item (out of 14) from this construct. The initial path diagram and GOF statistics of the final measurement model of global business performance construct are presented in Figure 5.28 and Table 5.55.

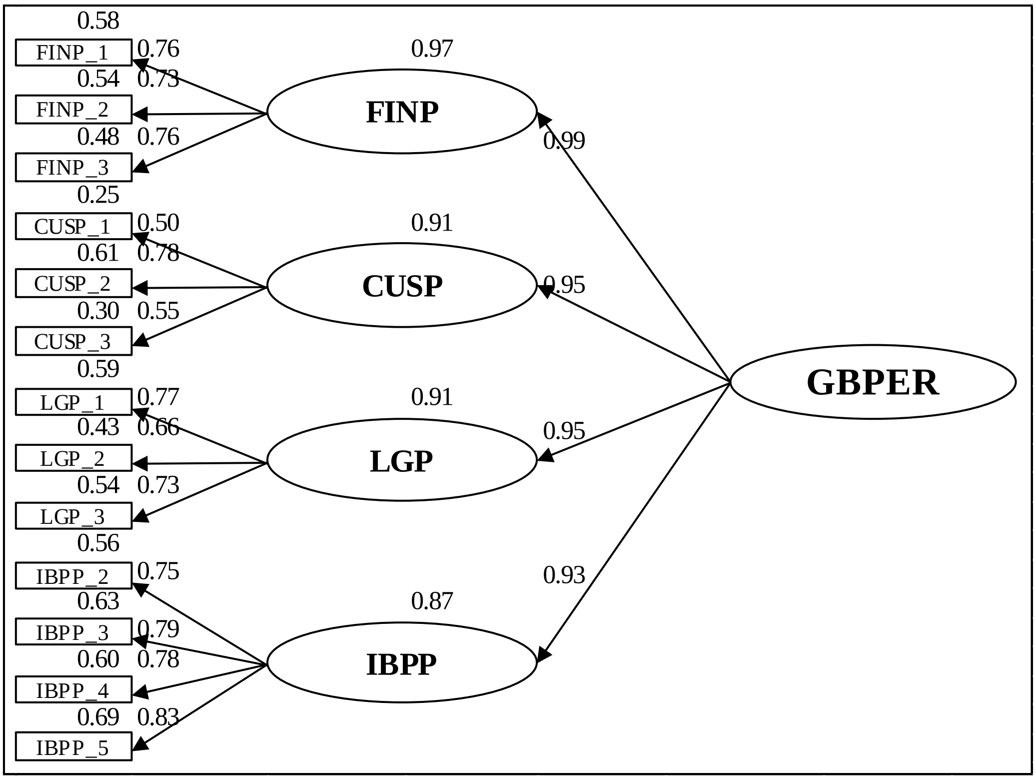


Figure 5-28: Path diagram of the final measurement model of GBPER construct

Table 5-55: GOF statistics of the global business performance construct

Model identification		**GOF statistics**			
No. of observed variables	13	Bootstrap p	0.428	CFI	0.994
No. of estimated parameters	52	X^2	69.084	TLI	0.992
DF	61	(X^2/DF)	1.133	RFI	0.933
Model is identified		RMSEA	0.026	AGFI	0.923
		SRMR	0.034	PCLOSE	0.928

Final measurement model of GBPER fits well with a chi-square of 69, 61 DF and a p-value of 0.428. Normed chi-square (1.133) is within the accepted range between 1 and 2. RMSEA (0.026) and SRMR (0.034) are well below the recommended thresholds of 0.08 and 0.09. CFI (0.99), TLI (0.99) and RFI (0.93) are well above the recommended threshold of 0.92. AGFI (0.92) is close to the recommended threshold of 0.95. PCLOSE (0.93) is well above the recommended value of 0.05. SRW and SMC of all the variables are also greater than the accepted values of 0.5 and 0.3. These results suggest that the final measurement model of GBPER is a good fitting model.

Standardised factor loadings of all the variables are approximately the same for all indicator variables of GBPER construct (0.93 - 0.99). This indicates that they are parallel measures of GBPER construct (Holmes-Smith, 2011). Furthermore, squared multiple correlations of all the indicator variables are greater than or closer to 0.9, suggesting that the latent construct (GBPER) accounts for about 90% of the variance in each of the indicators and they are good measures of the GBPER construct (Holmes-Smith, 2011). The next section discusses the reliability and validity of the measurement model concerning global business performance construct.

5.6.6 Reliability and validity of GBPER construct

To establish the validity of the measurement model of global business performance construct, reliability, convergent validity and discriminant validity were assessed. Reliability of the variables was measured using reliability coefficient (Cronbach’s alpha), Hancock and Mueller’s coefficient H and AVE. SMC was used to measure item reliability. Convergent validity was measured using SFL, AVE and Cronbach’s alpha. Chi-square difference test was used to measure discriminant validity of the model. The results of reliability and convergent validity tests are shown in Table 5.56 and the results of discriminant validity are presented in Tables 5.57, 5.58 and 5.59.

Table 5-56: Reliability and convergent validity of measurement model of GBPER

Item	Variable	Reliability				Convergent validity			Remarks
		Cronbach's alpha	H	AVE	SMC	SFL	AVE	Cronbach's alpha	
FINP_1	**Financial performance**	0.77	0.79	0.54	0.63	0.80	0.54	0.77	Reliability & convergent validity hold
FINP_2					0.41	0.64			Reliability & convergent validity hold
FINP_3					0.59	0.77			Reliability & convergent validity hold
CUSP_1	**Customer performance**	0.81	0.67	0.38	0.27	0.52	0.38	0.81	Reliability & convergent validity hold
CUSP_2					0.54	0.74			Reliability & convergent validity hold
CUSP_3					0.34	0.58			Reliability & convergent validity hold
LGP_1	**Learning and growth performance**	0.75	0.78	0.53	0.61	0.78	0.53	0.75	Reliability & convergent validity hold
LGP_2					0.44	0.66			Reliability & convergent validity hold
LGP_3					0.55	0.74			Reliability & convergent validity hold
IBPP_2	**Internal business process performance**	0.91	0.87	0.62	0.54	0.74	0.62	0.91	Reliability & convergent validity hold
IBPP_3					0.62	0.79			Reliability & convergent validity hold
IBPP_4					0.63	0.80			Reliability & convergent validity hold
IBPP_5					0.69	0.83			Reliability & convergent validity hold

Cronbach's alpha for all the variables (0.75 to 0.91) are within the recommended value of 0.7, co-efficient Hs (0.67 to 0.87) are greater than or close to the recommended threshold of 0.7. AVEs (0.53 to 0.62) are greater than the recommended threshold of 0.5, except customer performance variable (0.38). SMCs and SFLs of all the items are greater or close to 0.3 and 0.5. These results provide satisfactory evidence for high reliability and convergent validity of the measurement model of global business performance construct.

Discriminant validity of the measurement model of GBPER

Table 5-57: Chi-square of unconstrained and constrained models

Variable	FINP		CUSP		LGP		IBPP	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM
FINP	-	-						
CUSP	18.73	82.80	-	-				
LGP	7.97	56.27	15.83	72.56	-	-		
IBPP	18.58	78.92	14.05	76.43	14.97	67.87	-	-
UCM - Unconstrained model **CM - Constrained model**								

Table 5-58: DF of unconstrained and constrained models

Variable	FINP		CUSP		LGP		IBPP	
	UCM	CM	UCM	CM	UCM	CM	UCM	CM
FINP	-	-						
CUSP	8.00	9.00	-	-				
LGP	8.00	9.00	8.00	9.00	-	-		
IBPP	13.00	14.00	13.00	14.00	13.00	14.00	-	-
UCM - Unconstrained model CM - Constrained model								

Table 5-59: Chi-square difference test

Variable	FINP			CUSP			LGP			IBPP			
	Δ X^2	Δ DF	Pro	Δ X^2	Δ DF	Pro	Δ X^2	Δ DF	Pro	Δ X^2	Δ DF	Pro	Remarks
FINP	-	-											Discriminant validity holds
CUSP	64.07	1.00	0.00	-	-								Discriminant validity holds
LGP	48.30	1.00	0.00	56.72	1.00	0.00	-	-					Discriminant validity holds
IBPP	60.35	1.00	0.00	62.39	1.00	0.00	52.90	1.00	0.00	-	-		Discriminant validity holds
Δ X^2	**Difference in chi-square**												
Δ DF	**Difference in degree of freedom**												
P	**Probability**												

Chi-square test was performed to assess the discriminant validity of the measurement model of global business performance construct. Results indicate that the chi-square statistics for the unconstrained model are significantly lower than the constrained model. Furthermore, p-values of all variables are 0.000. These results provide adequate evidence supporting the discriminant validity of the measurement model of global business performance construct.

5.7 Full CFA measurement model

The objective in developing a full CFA measurement model is to determine the validity of the combined measurement model (global business information requirements, ERP systems capabilities and global business performance) (Kenaszchuk et al., 2010). As recommended by Hair et al. (2010) this research adopts a two-step approach for validating the research model using SEM. First step is to test fit and construct validity of the measurement models including the full measurement model. Once a satisfactory measurement model is established, the second step is to test the structural model (Hair et al., 2010). Separate testing of measurement model and structural model using a two-step approach is very important because a valid structural theory test can not be conducted using bad measures (Hair et al., 2010). The testing of the theoritical relationship (structural model) is meaningless without first establishing the measurement model (Schumacker and Lomax, 2010). Hence, the full measurement model shuold be tested prior to testing the structural model (Schumacker and Lomax, 2010). The next section discusses the full measurement model of the proposed research. Chapter 6 discusses the testing and validation of this structural model (step 2).

The preceeding discussion established one factor congeneric measurement models of each variable seperately. Using the input of one factor congeneric measurement models, it established measurement models for three main constructs (global business information requirements, ERP systems capabilities and global business performance). This section discusses the full CFA measurement model which was derived from the input of one factor congeneric and measurement models of three main constructs as discussed in the preceeding section. The full CFA model is illustrated in Figure 5.29.

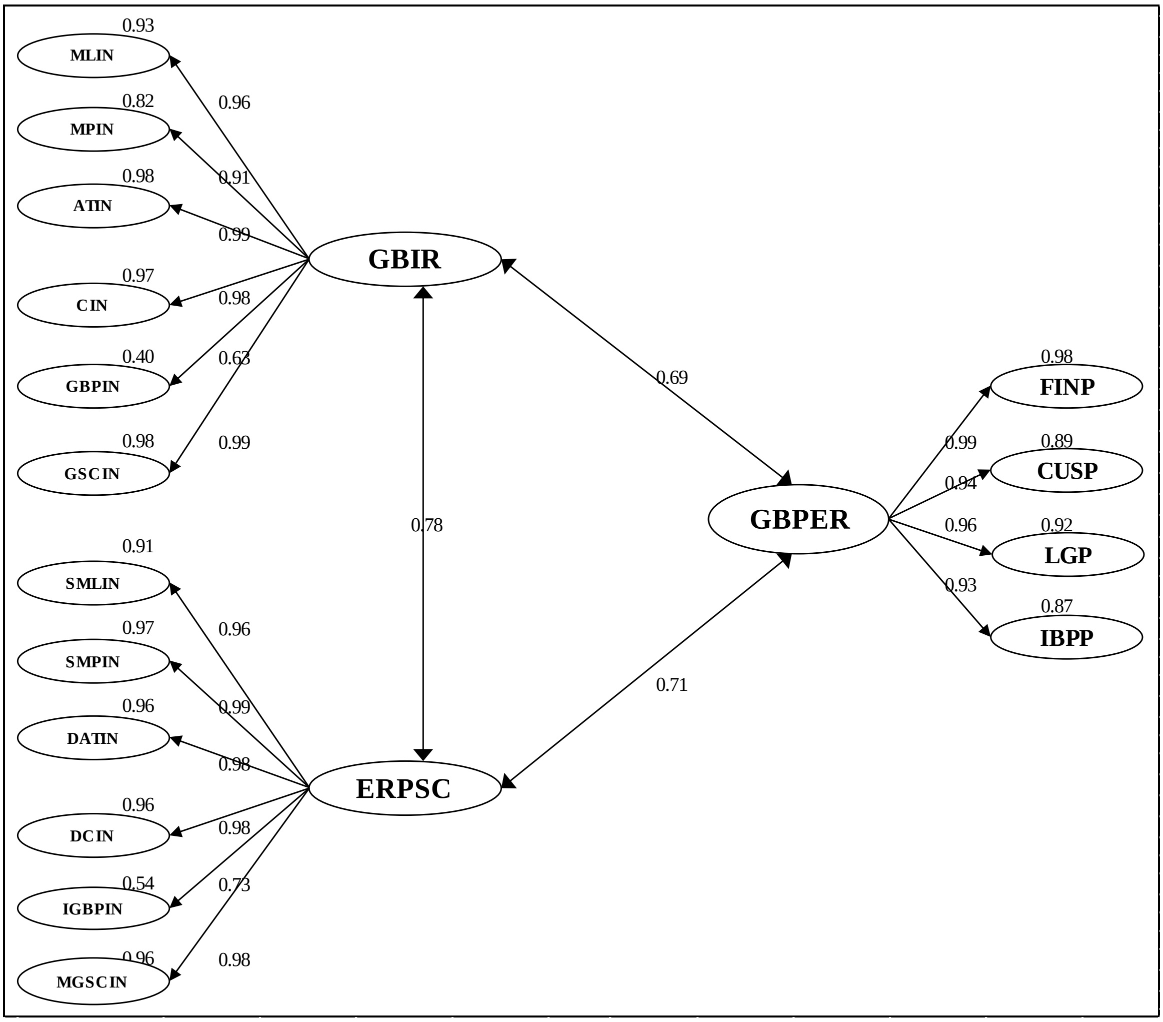


Figure 5-29: Full CFA model

As depicted in Figure 5.29 the full CFA model consists of three main constructs. The first two constructs, GBIR and ERPSC, each have six indicator variables while the third construct (GBPER) has four indicator variables. The original instrument contained 14 independent variables, 4 dependent variables, 2 moderating variables and 77 items. However, the one factor measurement model development process reduced the number of independent variables to 12 and items to 53. The number of dependent variables and moderator variables were unchanged. Relationships between these three constructs are estimated by correlational relationships. Figure 5.29 also indicates that there is a significant correlation between GBIR and ERPSC (0.78), GBIR and GBPER (0.69) and

ERPSC and GBPER (0.71). Statistical results of the full CFA model are presented in Table 5.60.

Table 5-60: Statistical results of the full CFA model

Model identification		GOF statistics			
No. of observed variables	52	Bootstrap p	0.438	CFI	0.951
No. of estimated parameters	210	X^2	1650.12	TLI	0.948
DF	1255	(X^2/DF)	1.315	RFI	0.815
Model is identified		RMSEA	0.040	AGFI	0.742
		SRMR	0.053	PCLOSE	0.999

The full CFA model was identified with a chi-square of 1650, 1255 DF and a p-value of 0.438. RMSEA is 0.04, well below the 0.08 threshold (Hair et al., 2010). SRMR is 0.053, well below the accepted threshold of 0.09 (Hair et al., 2010). CFI (0.95) and TLI (0.95) are above the recommended threshold of 0.09 (Hair et al., 2010; Schumacker and Lomax, 2010). PCLOSE value is 0.99, well above the recommended threshold of 0.05 (Hair et al., 2010; Holmes-Smith, 2011). These results indicate that the full CFA model achieves an acceptable fit. Reliability, convergent validity and discriminant validity results for the full CFA model are discussed in the next section.

5.7.1 Reliability and convergent validity of the full CFA model

This section discusses reliability and convergent validity of the full CFA model. Reliability is measured using reliability co-efficient (Cronbach’s alpha), Hancock and Mueller’s coefficient H, AVE and SMC. Convergent validity is measured using SFL, AVE and Cronbach’s alpha. Results of reliability and convergent validity tests of the full CFA model are presented in Table 5.61.

Table 5-61: Reliability and convergent validity

Variable	Construct	Reliability				Convergent validity			Remarks
		Cronbach's alpha	H	AVE	SMC	SFL	AVE	Cronbach's alpha	
MLIN	**Global business information requirements**	0.88	0.99	0.85	0.925	0.962	0.85	0.88	Reliability & convergent validity hold
MPIN		0.87			0.824	0.908		0.87	Reliability & convergent validity hold
ATIN		0.85			0.976	0.988		0.85	Reliability & convergent validity hold
CIN		0.92			0.968	0.984		0.92	Reliability & convergent validity hold
GBPIN		0.83			0.401	0.633		0.83	Reliability & convergent validity hold
GSCIN		0.91			0.984	0.992		0.91	Reliability & convergent validity hold
SMLIN	**ERP systems capabilities**	0.91	0.99	0.88	0.914	0.956	0.88	0.91	Reliability & convergent validity hold
SMPIN		0.89			0.970	0.985		0.89	Reliability & convergent validity hold
DATIN		0.91			0.962	0.981		0.91	Reliability & convergent validity hold
DCIN		0.97			0.964	0.982		0.97	Reliability & convergent validity hold
IGBPIN		0.93			0.537	0.733		0.93	Reliability & convergent validity hold
MGSCIN		0.94			0.964	0.982		0.94	Reliability & convergent validity hold
FINP	**Global business performance**	0.87	0.99	0.92	0.978	0.989	0.92	0.87	Reliability & convergent validity hold
CUSP		0.81			0.889	0.943		0.81	Reliability & convergent validity hold
LGP		0.85			0.916	0.957		0.85	Reliability & convergent validity hold
IBPP		0.91			0.872	0.934		0.91	Reliability & convergent validity hold

As shown in Table 5.61 the full CFA model has high reliability and convergent validity. Cronbach's alpha for all the variables (0.81 to 0.97) are greater than the recommended value of 0.7. Co-efficient Hs (0.99) are greater than the recommended threshold of 0.7. AVEs (0.85, 0.88 and 0.92) are greater than the recommended thresholds of 0.5. SMC and SFL of all the variables are greater than the recommended thresholds of 0.3 and 0.5. Furthermore, correlational relationships among the three main constructs are below the recommended threshold of 0.85 (Paschke, 2009).

5.7.2 Discriminant validity of the full CFA model

Discriminant validity of the full CFA model was determined using chi-square difference test as recommended by Hair et al. (2010) and Holmes-Smith (2011). The results of discriminant validity tests are displayed in Tables 5.62, 5.63 and 5.64.

Table 5-62: Chi-square of unconstrained and constrained models

Variable	GBIR		ERPSC		PER	
	UCM	CM	UCM	CM	UCM	CM
GBIR	-	-				
ERPSC	1018.7	1084.2	-	-		
PER	502.75	594.88	609.18	665.09	-	-

UCM - Unconstrained model
CM - Constrained model

Table 5-63: DF of unconstrained and constrained models

Variable	GBIR		ERPSC		PER	
	UCM	CM	UCM	CM	UCM	CM
GBIR	-	-				
ERPSC	689	690	-	-		
PER	453	454	484	485	-	-

UCM - Unconstrained model
CM - Constrained model

Table 5-64: Chi-square difference test

	GBIR			ERPSC			PER		
	ΔX^2	Δ DF	P	ΔX^2	Δ DF	P	ΔX^2	Δ DF	P
GBIR	-	-							
ERPSC	65.4	1.0	0.0	-	-				
GBPER	92.1	1.0	0.0	55.9	1.0	0.0	-	-	
ΔX^2	Difference in chi-square								
Δ DF	Difference in degree of freedom								
P	Probability								

Table 5.64 demonstrates that the full CFA model has sufficient discriminant validity. Chi-square statistics of unconstrained model are significantly lower than the constrained model. All the constructs reach a p- value of 0.000. These results indicate that the full CFA model fits well. Therefore, these measures now can be used to test the structural model validity. The validation of the structural model is discussed in the next chapter.

5.8 Summary

This chapter discussed the validation of measurement model for this research. SEM was used to validate the measurement models. CFA technique has been used to test the measurement models of three main constructs (GBIR, ERPSC and GBPER) and the full CFA measurement model. Results indicate that all three constructs and the full CFA model achieve an acceptable fit, convergent validity, discriminant validity and reliability. Findings confirmed that global organisations have unique information requirements somewhat different to local businesses. These include multi-level information, multi-purpose information, accurate and timely information, consolidated information, global business process information, global supply chain information and secure information. ERP systems also have capabilities that can meet global business information requirements. Furthermore, co-alignment of global business information requirements and ERP systems capabilities deliver improved financial, customer, learning and growth and better internal business process performance. Results also indicate that the observed variables of all three constructs are approximately the same and are good measures of those constructs. These results will be used in the following chapter to validate the structural model and test the research hypotheses.

CHAPTER 6. STRUCTURAL MODEL VALIDATION AND HYPOTHESES TESTING

6.1 Introduction

Having established the goodness of fit, validity and reliability of the measurement models the next step is to assess the validity of the structural model. This model involves specifying the structural relationships between latent variables or testing the hypothesised relationships (Hair et al., 2010; Schumacker and Lomax, 2010; Schwarz et al., 2010). Indeed the structural model tests the relationships among variables as demanded by theory (Schumacker and Lomax, 2010), indicating which constructs are related to each other and the nature of their relationships (Hair et al., 2010). The structural model differs from the measurement model in that the emphasis moves from testing the relationship between latent construct and measured variables to the relationships between constructs (Hair et al., 2010). It also provides an assessment of the model's nomological validity (Schumacker and Lomax, 2010). In this research, structural equation modelling (SEM) was used to assess and validate the structural model.

Structural model involves testing of two types of relationships namely, dependence and correlational relationships (Hair et al., 2010). The dependence relationship tests the relationship between constructs and variables or between constructs, thus, arrows are pointing from the antecedents (independent variables) to the outcome (dependent variables) (Hair et al., 2010). The correlational relationship tests the relationship between constructs, which are assumed to be correlated in this type of relationship. Thus, they are connected by two headed arrows, assuming that the constructs do not depend on each other (Hair et al., 2010).

As discussed in Chapter 2 the theoretical relationships and structural model of this research are derived from the extant literature on global business, ERP systems, business performance and IT/IS alignment. The objectives of this research are to:

1) Establish information requirements of global businesses.

2) Determine to what extent ERP systems can meet global business information requirements.

3) Determine the impact of aligning ERP systems capabilities to global business information requirements for improved global business performance.

In order to establish the effect of co-alignment of global business information requirements and ERP systems capabilities for improved business performance, two types of structural relationships (models) need to be tested: co-alignment (co-variation) relationship (model) and direct effect relationship (model) (Venkatraman, 1989, 1990; Croteau and Raymond, 2004). This chapter begins with a discussion of the co-alignment model, followed by the direct effect model, and then compares them. The chapter concludes with a discussion of moderator variables and hypotheses validation.

6.1.1 Co-alignment model

The co-alignment model adopts Venkatraman's (1989) perspective of fit as co-alignment/co-variation. This is the structural model, which represents the conceptual relationship among constructs. Theoretical relationship of the co-alignment model was drawn from previous studies on IT/IS-business alignment, ERP systems, global business and business performance. The co-alignment among factors is considered as an unobservable theoretical construct on a higher plane than individual functional dimensions (Venkatraman, 1989). There are no directly observable indicators for this construct. Consequently, co-alignment is derived through a third order reflective construct, derived from two second order constructs, namely global business information requirements and ERP systems capabilities, as suggested by Venkatraman (1989, 1990), Croteau and Raymond (2004) and Wang et al. (2008). Co-alignment between these two dimensions (global business information requirements and ERP systems capabilities) is documented as a separate unobservable construct that has no direct observable indicators (Venkatraman, 1990). Business performance is also linked to the co-alignment through a second order reflective construct, derived from four first order constructs, namely financial, customer, learning and growth and internal business process performance.

Diamantopoulos and Siguaw (2006) and Diamantopoulos (2011) argued that choosing the measurement perspective whether reflective or formative should be driven by a theory. As suggested by theory (covariation perspective of fit) main constructs, GBIR, ERPSC and GBPER, in this research were formulated as reflective and the relationship between co-alignment and business performance was formulated as a formative one (Venkatraman, 1990; Croteau and Raymond, 2004).

Hypothesized relationships of the latent variables are derived through four latent dependent variables: financial performance, customer performance, learning and growth performance and internal business process performance. Thus, the proposed research model contains four structural equations. The first equation is that financial performance is predicted by the co-alignment of global business information requirements and ERP system capabilities. The second equation is that customer performance is predicted by the co-alignment of global business information requirements and ERP system capabilities. The third equation is that learning and growth performance is predicted by the co-alignment of global business information requirements and ERP system capabilities. The fourth equation is that internal business process performance is predicted by the co-alignment of global business information requirements and ERP system capabilities. The path diagram for the co-alignment model is shown in Figure 6.1.

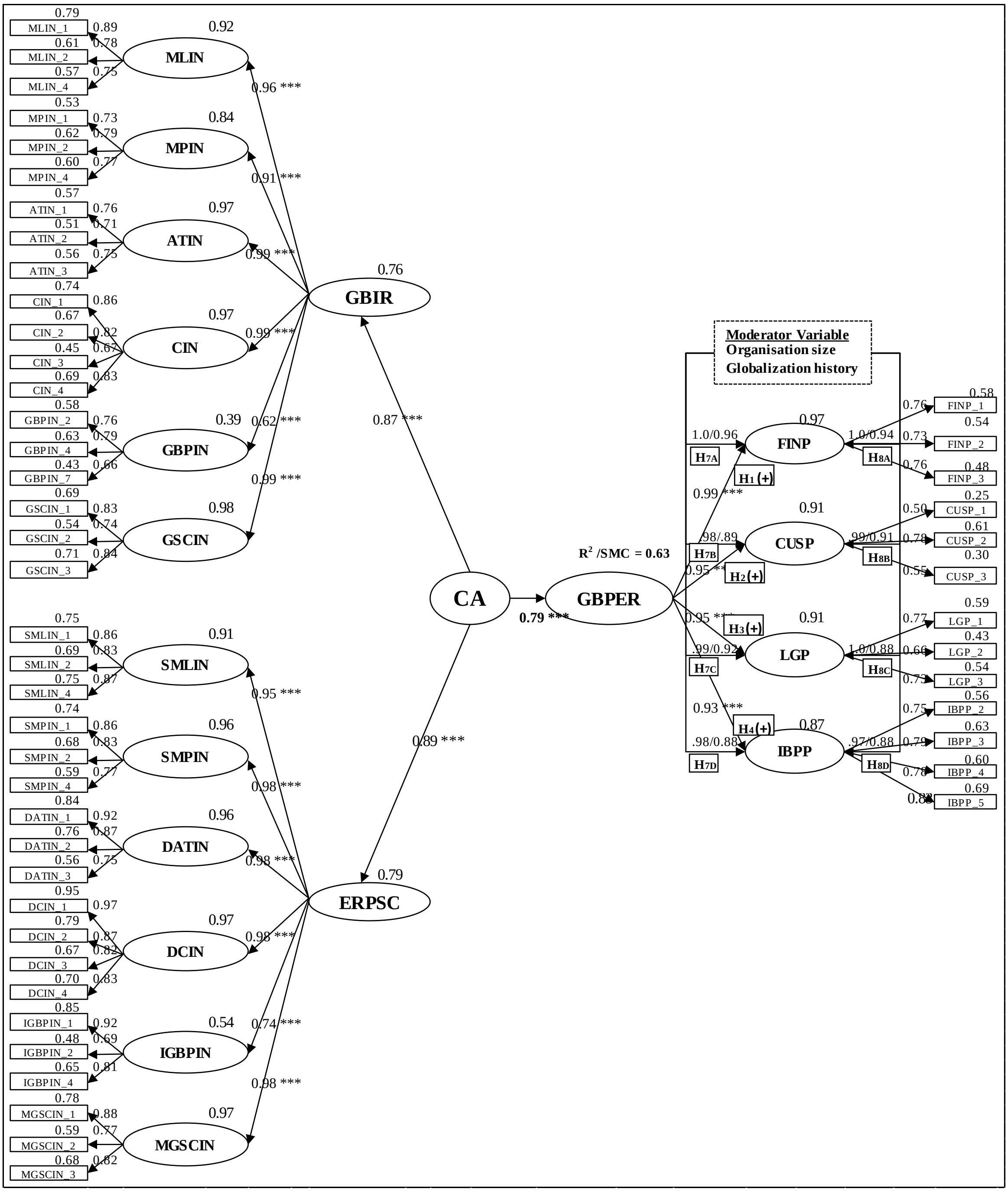


Figure 6-1: Path diagram of the co-alignment model.

Figure 6.1 shows the co-alignment effect that global business information requirements and ERP systems capabilities have on global business performance. In this model, rather than directly linking global business information requirements and ERP systems capabilities to global business performance, it predicts that the co-alignment (co-variation effect) delivers improved global business performance. The latent dependent variables of the model are: financial performance, customer performance, learning and growth performance and internal business process performance. There are three independent latent variables in the model, specifically global business information requirements, ERP systems capabilities and co-alignment.

The GBIR and ERPSC constructs are modelled as second order reflective ones comprising six first order reflective variables. The GBPER construct is modelled as a second order reflective construct consisting of four first order reflective variables. These constructs have been developed as reflective as indicators of these constructs are interchangeable and share common themes for supporting global business operations, global business information requirements and global business performance. They are in fact the key determining factors of reflective constructs (Jarvis et al., 2003; Petter et al., 2007; Wang et al., 2008). The relationship between CA and GBPER has been modelled as a formative one because GBIR and ERPSC are not interchangeable. Additionally they do not share a common theme (requirements vs capabilities) (Jarvis et al., 2003).

Overall, the co-alignment model contains twelve observed variables and four hypothesized latent variables. As shown in Figure 6.1 arrows are drawn from the latent variables to each of its observed indicator variables. For example, there are six arrows going from the latent variable of global business information requirements to observed variables, MLIN, MPIN, ATIN, CIN, GBPIN and GSCIN. A total of seventy (70) arrows exist representing the relationship between latent and observed variables in the model. The relationships represented by these arrows were estimated with seventy (70) factor loadings and they are depicted above the arrows. Furthermore, each observed variable has a unique measurement error to accommodate random or systematic error, which may not be a part of the latent variable (Schumacker and Lomax, 2010).

Arrows leading from latent independent variables (GBPER) to latent dependent variables (FINP, CUSP, LGP, and IBPP) represent the hypothesized relationships in the model. As discussed in the literature review they originated from the literature and represent a structural relationship of the model. Structural coefficients need to be estimated for these arrows (Schumacker and Lomax, 2010). There are four main structural coefficients to be estimated in the co-alignment (structural) model. They are denoted by arrows pointing from GBPER to FINP, CUSP, LGP and IBPP.

6.1.2 Co-alignment model assessment

This section discusses the validation of the co-alignment model, which is the final stage (stage 6) of the six stage process discussed in Chapter 5. Structural model validity is evaluated comparing structural model fit with the CFA (measurement) model as well as examining GOF statistics and other diagnostics measures as recommended by Hair et al. (2010); Schumacker and Lomax (2010) and Holmes-Smith (2011). Statistical significance of hypothesized paths is also important in determining the validity of structural model (Hair et al., 2010). If the model has a good fit, and hypothesized paths are significant and heading in the hypothesised direction (positive or negative), then the model can be accepted as a valid model (Hair et al., 2010). Model fit statistics of the co-alignment model are presented in Table 6.1.

Table 6-1: Model fit statistics of the co-alignment model

Model identification		**GOF statistics**			
No. of observed variables	52	Bootstrap p	0.44	CFI	0.95
No. of estimated parameters	214	X^2	1,650	TLI	0.95
DF	1255	(X^2/DF)	1.32	RFI	0.82
Model is identified		RMSEA	0.04	AGFI	0.74
		SRMR	0.05	PCLOSE	0.99

As shown in Table 6.1 the co-alignment model achieves an acceptable fit with a chi-square of 1,650, 1255 DF and a p-value of 0.44 (Hair et al., 2010). Normed chi-square (1.32) is within the accepted range between 1 and 2. RMSEA (0.04) is well below the recommended threshold of 0.08. SRMR (0.05) is well below the recommended threshold of 0.09. CFI (0.95) and TLI (0.95) are well above the recommended threshold of 0.92. PCLOSE (0.99) is well above the recommended value of 0.05. SRWs of all the variables are greater than the accepted value of 0.5. SMCs of all the variables are greater than or close to the accepted value of 0.3. CRs of all the variables are also within the accepted range of ±1.96. Only AGFI (0.74) and RFI (0.82) are not within the accepted thresholds of 0.95 and 0.92. These results suggest that the co-alignment model is a good fitting model.

Standardised factor loadings of all the observed variables of GBIR, ERPSC and GBPER constructs (0.91 to 0.99) are approximately the same except IGBPIN (0.74) and GBPIN (0.62) variables. These results indicate that they are parallel measures for GBIR, ERPSC and GBPER constructs (Holmes-Smith, 2011). Furthermore, squared multiple correlations of all the indicator variables of all three constructs are greater than or closer to 0.9, except GBPIN variable (0.39) of GBIR construct and IGBPIN variable (0.54) of ERPSC construct. This indicates that all three latent constructs, GBIR, ERPSC and GBPER account for about 90% of the variance in each of the indicators and they are good measures of those constructs (Holmes-Smith, 2011).

It is also apparent that there is a strong correlation (path co-efficient of 0.79) between co-alignment of the two constructs, global business information requirements and ERP systems capabilities and resulting global business performance. This confirms the magnitude and significance of the performance effect of co-alignment (Croteau and Raymond, 2004). The correlation between co-alignment and financial (0.99), customer (0.95), learning and growth (0.95) and internal business process (0.93) performance outcomes are significant. More importantly, a significant amount of the variance (R^2/SMC = 0.63) in global business performance is explained by the co-alignment of global business information requirements and ERP systems capabilities. Modification indices do not provide any suggestion to covary ERPSC and GBPER and GBIR to GBPER, indicating that the co-alignment approach is an appropriate method for establishing global business performance. The next section discusses the results of the direct effect model.

6.1.3 Direct effect model

The direct effect model is an alternative to the co-alignment model in which the first order constructs are assumed not to covary and have a direct causal influence on performance (Venkatraman, 1989, 1990; Croteau and Raymond, 2004). Neither does the direct effect model provide any insight into the pattern of co-variation among the dimensions in the model (Venkatraman, 1989). Thus, in this particular model it is hypothesised that the global business information requirements and ERP systems capabilities do directly influence global business performance, without the influence of co-alignment. In other words, in this model there are direct causal links between global business information requirements and global business performance and ERP systems capabilities and global business performance. This model tests the rival hypotheses (rival model) of the co-alignment model. The path diagram of the direct effect model is shown in Figure 6.2.

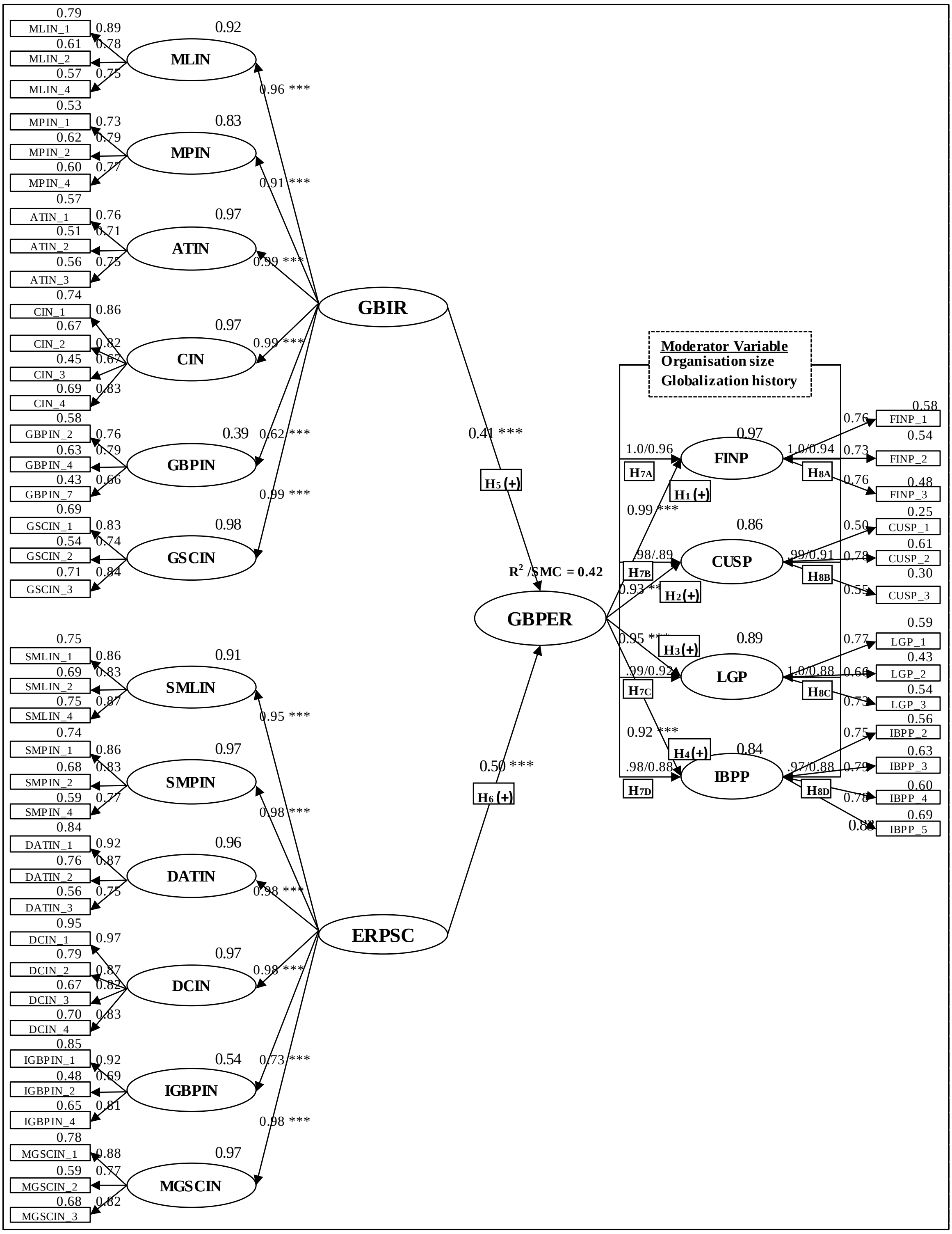


Figure 6-2: The path diagram of the direct effect model

Figure 6.2 indicates the direct effect that the global business information requirements and ERP systems capabilities have on global business performance. GBIR and ERPSC constructs are modelled as second order reflective constructs comprising six first order reflective variables. GBPER construct is modelled as a second order reflective construct comprising four first order reflective variables. Three main constructs of this model have been developed as reflective since indicators of three main constructs are interchangeable and share common themes of supporting global business operations, global business information requirements and global business performance, which are key determining factors of reflective constructs (Jarvis et al., 2003; Petter et al., 2007; Wang et al., 2008). The relationships between GBIR and GBPER and ERPSC and GBPER have been modelled as a formative since GBIR and ERPSC are not interchangeable and they share two different themes (requirements vs. capabilities) (Jarvis et al., 2003).

According to Diamantopoulos and Siguaw, (2006) the choice of the measurement perspective as reflective or formative should be based on theoretical considerations regarding the direction of the links between the constructs and its indicators. The directions and the links of the direct effect model were based on the theoretical considerations of Venkatraman's co-variation perspectives (Venkatraman, 1990; Croteau and Raymond, 2004). Path coefficients (expected direction) between global business information requirements and global business performance and ERP systems capabilities and global business performance are significant (0.41/0.50), and they verify the correct path direction.

6.1.4 Direct effect model assessment

This section discusses the validation of the direct effect model. Model fit statistics of this model is presented in Table 6.2.

Table 6-2: Model fit statistics of the direct effect model

<table>
<tr><th colspan="5">Model identification</th><th colspan="4">GOF statistics</th></tr>
<tr><td colspan="4">No. of observed variables</td><td>52</td><td>Bootstrap p</td><td>0.17</td><td>CFI</td><td>0.93</td></tr>
<tr><td colspan="4">No. of estimated parameters</td><td>212</td><td>X^2</td><td>1,811</td><td>TLI</td><td>0.93</td></tr>
<tr><td colspan="4">DF</td><td>1256</td><td>(X^2/DF)</td><td>1.44</td><td>RFI</td><td>0.80</td></tr>
<tr><td colspan="5" rowspan="2">Model is identified</td><td>RMSEA</td><td>0.05</td><td>AGFI</td><td>0.73</td></tr>
<tr><td>SRMR</td><td>0.26</td><td>PCLOSE</td><td>0.79</td></tr>
<tr><th colspan="9">Factor loadings</th></tr>
<tr><th>Item</th><th></th><th>Variable</th><th>SRW</th><th>SMC</th><th colspan="4">Comment</th></tr>
<tr><td>GBPER</td><td><---</td><td>GBIR</td><td>0.412</td><td></td><td colspan="4">SRW is very low</td></tr>
<tr><td>CUSP_1</td><td><---</td><td>CUSP</td><td>0.454</td><td></td><td colspan="4">SRW is very low</td></tr>
<tr><td>CUSP_1</td><td></td><td></td><td></td><td>0.206</td><td colspan="4">SMC is very low</td></tr>
<tr><td>CUSP_3</td><td></td><td></td><td></td><td>0.261</td><td colspan="4">Smc is very low</td></tr>
<tr><td colspan="9">DF: Degree of freedom
SRW: Standardised regression weight
CR: Critical ratio
SMC: Squared multiple correlations</td></tr>
</table>

Table 6.2 lists a chi-square value of 1811, DF value of 1256 and a p-value of 0.17 indicating a good fit for the direct effect model. Normed chi-square (1.44) is within the accepted range between 1 and 2. RMSEA (0.05) is well below the recommended threshold of 0.08. CFI (0.93) and TLI (0.93) are above the recommended threshold of 0.92. PCLOSE (0.79) is well above the recommended threshold of 0.05. However, SRMR (0.26), AGFI (0.73) and RFI (0.80) are not within the accepted thresholds of 0.09, 0.95 and 0.92. These results indicate that the direct effect model has an acceptable fit even though SRMR, AGFI and RFI are not within the acceptable ranges.

SRWs of all the paths are greater than the accepted value of 0.5, except GBIR → GBPER (0.41). SMCs of all the variables are greater than the accepted value of 0.3, except CUSP_1 (0.25). CRs of all the variables are also within the accepted range of ±1.96. These results further confirm that the direct effect model has an acceptable fit.

Standardised factor loadings of all the observed variables (0.91 to 0.99) of all three constructs (GBIR, ERPSC and GBPER) are approximately the same except GBPIN (0.62) and IGBPIN (0.73) variables. This indicates that they are parallel measures of GBIR, ERPSC and GBPER constructs (Holmes-Smith, 2011). Furthermore, squared multiple correlations of all the indicator variables are greater than or closer to 0.9, except GBPIN (0.39) and IGBPIN (0.54) variables. This suggests that all three latent constructs, GBIR, ERPSC and GBPER account for about 90% of the variance in each of the indicators and are good measures of those constructs (Holmes-Smith, 2011). The following section compares the results of the co-alignment model and the direct effect model to establish the model that has the highest parsimony.

6.1.5 Comparison of the co-alignment and direct effect models

This section presents a comparison of the results for the co-alignment and direct effect models. The main difference between them is that co-alignment does not appear in the direct effect model. Thus, the arrows are pointing from GBIR and ERPSC to GBPER. On the other hand, in the co-alignment model, GBPER is derived (reflected) through the co-alignment of global business information requirements and ERP systems capabilities. The statistical results discussed in the above section indicate that both models achieved an acceptable fit. However, in order to determine the model that has better goodness of fit, explanatory power and delivers greater business performance, model fit statistics for these two models were compared as suggested by Venkatraman (1989, 1990) and Croteau and Raymond (2004). Table 6.3 presents a comparison of fit statistics for the co-alignment and direct effect models.

Table 6-3: Comparison of model fit statistics of the co-alignment and direct effect models

Model identification & GOF statistics			
Model identification & GOF statistics	**Co-alignment model**	**Direct effect model**	**Difference**
No. of observed variables	52	52	**-**
No. of estimated parameters	214	212	**2.00**
DF	1,255	1,256	**(1)**
Bootstrap p	0.438	0.174	**0.26**
X^2	1,650	1,811	**(161)**
(X^2/DF)	1.315	1.442	**(0.13)**
RMSEA	0.040	0.048	**(0.01)**
SRMR	0.053	0.264	**(0.21)**
CFI	0.951	0.931	**0.02**
TLI	0.948	0.927	**0.02**
RFI	0.815	0.797	**0.02**
AGFI	0.742	0.734	**0.01**
PCLOSE	0.999	0.792	**0.21**
Variance explained in business performance (R^2/SMC)	0.63	0.42	**0.21**

It is apparent from Table 6.3 that the direct effect model has a worse fit than the co-alignment model (p-value = 0.17 vs 0.44, RMSEA = 0.048 vs 0.040, SRMR = 0.264 vs 0.053, CFI = 0.93 vs 0.95, TLI = 0.93 vs 0.95, RFI = 0.80 vs 0.82, AGFI = 0.73 vs 0. 74, PCLOSE = 0.79 vs 1.00). Furthermore the direct effect model explains 21% less variance (SMC/ (R^2)) = 0.42 vs 0.63) in business performance. Positive and significant path coefficients between global business information requirements and co-alignment (0.87) and ERP systems capabilities and co-alignment (0.89) in the co-alignment model when compared to the same in the direct effect model (0.41 and 0.50), suggest a better fit in the co-alignment model. Findings also support the main research proposition that global organisations can perform better by co-aligning their information requirements and ERP systems capabilities. The impact of co-alignment on financial, customer, learning and growth and internal business process performance is positive and significant.

Poor goodness of fit, explanatory power and path significance determined from the quantitative analysis above suggest that the direct effect model be rejected in favour of a more parsimonious co-alignment model. The reliability and validity of the co-alignment model is discussed in the next section.

6.2 Reliability and validity of the co-alignment model

Reliability ensures that the model is free from random errors and validity ensures that the model is a perfect representation of the variables that the researcher intends to measure (Holmes-Smith, 2011). Reliability is concerned with the question of whether the results of the study are repeatable or stable (Bryman and Bell, 2007). Validity shows the integrity of the findings that are generated from research (Bryman and Bell, 2007). Improving reliability and validity of the model ensures that the impact of measurement errors (type 1 and 2) is minimised (Hair et al., 2010). Since reliability and validity have different meanings in relation to the evaluation of accuracy of a model (Bryman and Bell, 2007), both reliability and validity are measured and discussed in the next section.

6.2.1 Reliability

Reliability is the degree to which a variable or a set of variables is consistent or dependable on what it is intended to measure (Byrne, 2010; Hair et al., 2010). Reliability of an instrument can be measured using several methods including, squared multiple correlations (SMC), average variance extracted (AVE), construct reliability, Werts, Rock, Linn, and Joreskog's maximised reliability, Hancock and Mueller's maximised reliability and reliability coefficient (Cronbach's alpha) (Hair et al., 2010, Holmes-Smith, 2011). However, reliability coefficient (Cronbach's alpha) is the most commonly used method and the value of Cronbach's alpha greater than 0.7 suggests good reliability (Hair et al., 2010; George and Mallery, 2011). High construct reliability also ensures that the model has a high internal consistency (Hair et al., 2010). Reliability of the variables in the co-alignment model was measured using reliability coefficient (Cronbach's alpha), Hancock and Mueller's coefficient H and AVE. Furthermore, item reliability of the model was measured using SMC.

6.2.2 Validity

Validity refers to the extent to which the measure adequately represents the underlying construct that it is supposed to measure (Bhattacherjee, 2012). It is the extent to which a measure or set of measures correctly represent the concept of the study or the degree to which it is free from any systematic or non-random errors (Byrne, 2010; Hair et al., 2010).

6.2.3 Convergent validity

Convergent validity refers to the closeness with which a measure relates to the construct that it intends to measure (Bhattacherjee, 2012). Convergent validity can be measured in several ways, including standardised factor loadings (SFL), AVE and reliability of the construct (Cronbach's alpha) (Hair et al., 2010). The accepted values of SFL, AVE and H are respectively 0.5, 0.5 and 0.7 or greater (Hair et al., 2010; Holmes-Smith, 2011). Convergent validity of the co-alignment model was measured using SFL, AVE and Cronbach's alpha. Table 6.4 presents the results of reliability and convergent validity tests of the structural model (co-alignment model).

Table 6-4: Reliability and convergent validity tests of the structural model

Item	Variable	Reliability				Convergent validity			Remarks
		Cronbach's alpha	H	AVE	SMC	SFL	AVE	Cronbach's alpha	
MLIN_1	**Multi-level information**	0.88	0.87	0.66	0.79	0.89	0.66	0.88	Reliability & convergent validity hold
MLIN_2					0.54	0.73			Reliability & convergent validity hold
MLIN_4					0.66	0.81			Reliability & convergent validity hold
MPIN_1	**Multi-purpose information**	0.87	0.81	0.59	0.59	0.77	0.59	0.87	Reliability & convergent validity hold
MPIN_2					0.57	0.76			Reliability & convergent validity hold
MPIN_4					0.60	0.77			Reliability & convergent validity hold
ATIN_1	**Accurate and timely information**	0.85	0.78	0.54	0.56	0.75	0.54	0.85	Reliability & convergent validity hold
ATIN_2					0.49	0.70			Reliability & convergent validity hold
ATIN_3					0.58	0.76			Reliability & convergent validity hold
CIN_1	**Consolidated information**	0.92	0.89	0.64	0.70	0.84	0.64	0.92	Reliability & convergent validity hold
CIN_2					0.66	0.81			Reliability & convergent validity hold
CIN_3					0.47	0.68			Reliability & convergent validity hold
CIN_4					0.74	0.86			Reliability & convergent validity hold
GBPIN_2	**Global business process information**	0.78	0.79	0.55	0.56	0.75	0.55	0.78	Reliability & convergent validity hold
GBPIN_4					0.62	0.79			Reliability & convergent validity hold
GBPIN_7					0.47	0.68			Reliability & convergent validity hold
GSCIN_1	**Global supply chain information**	0.91	0.86	0.65	0.76	0.87	0.65	0.91	Reliability & convergent validity hold
GSCIN_2					0.49	0.70			Reliability & convergent validity hold
GSCIN_3					0.70	0.83			Reliability & convergent validity hold
SMLIN_1	**Support multi-level information**	0.91	0.90	0.73	0.77	0.88	0.73	0.91	Reliability & convergent validity hold
SMLIN_2					0.77	0.88			Reliability & convergent validity hold
SMLIN_4					0.67	0.82			Reliability & convergent validity hold
SMPIN_1	**Support multi-purpose information**	0.89	0.86	0.67	0.71	0.84	0.67	0.89	Reliability & convergent validity hold
SMPIN_2					0.69	0.83			Reliability & convergent validity hold
SMPIN_4					0.62	0.78			Reliability & convergent validity hold
DATIN_1	**Deliver accurate timely information**	0.91	0.89	0.73	0.77	0.88	0.73	0.91	Reliability & convergent validity hold
DATIN_2					0.75	0.87			Reliability & convergent validity hold
DATIN_3					0.67	0.82			Reliability & convergent validity hold
DCIN_1	**Deliver consolidated information**	0.97	0.97	0.77	0.96	0.98	0.77	0.97	Reliability & convergent validity hold
DCIN_2					0.76	0.87			Reliability & convergent validity hold
DCIN_3					0.67	0.82			Reliability & convergent validity hold
DCIN_4					0.69	0.83			Reliability & convergent validity hold
IGBPIN_1	**Integrate global business process information**	0.93	0.88	0.66	0.82	0.91	0.66	0.93	Reliability & convergent validity hold
IGBPIN_2					0.48	0.70			Reliability & convergent validity hold
IGBPIN_3					0.69	0.83			Reliability & convergent validity hold
MGSCIN_1	**Manage global supply chain information**	0.84	0.91	0.69	0.80	0.90	0.69	0.84	Reliability & convergent validity hold
MGSCIN_2					0.61	0.78			Reliability & convergent validity hold
MGSCIN_3					0.63	0.80			Reliability & convergent validity hold
MGSCIN_4					0.70	0.83			Reliability & convergent validity hold
FINP_1	**Financial performance**	0.77	0.79	0.54	0.63	0.80	0.54	0.77	Reliability & convergent validity hold
FINP_2					0.41	0.64			Reliability & convergent validity hold
FINP_3					0.59	0.77			Reliability & convergent validity hold
CUSP_1	**Customer performance**	0.81	0.67	0.38	0.27	0.52	0.38	0.81	Reliability & convergent validity hold
CUSP_2					0.54	0.74			Reliability & convergent validity hold
CUSP_3					0.34	0.58			Reliability & convergent validity hold
LGP_1	**Learning and growth performance**	0.75	0.78	0.53	0.61	0.78	0.53	0.75	Reliability & convergent validity hold
LGP_2					0.44	0.66			Reliability & convergent validity hold
LGP_3					0.55	0.74			Reliability & convergent validity hold
IBPP_2	**Internal business process performance**	0.91	0.87	0.62	0.54	0.74	0.62	0.91	Reliability & convergent validity hold
IBPP_3					0.62	0.79			Reliability & convergent validity hold
IBPP_4					0.63	0.80			Reliability & convergent validity hold
IBPP_5					0.69	0.83			Reliability & convergent validity hold

Table 6.4 indicates that the Cronbach's alpha (0.75 to 0.97) for all the variables are greater than the recommended threshold of 0.7, co-efficient Hs (0.67 to 0.97) are greater

than or close to recommended threshold of 0.7. AVEs (0.54 to 0.77) are greater than the recommended thresholds of 0.5, except for the customer performance variable (0.38). Although this variable has a low AVE, it is still reliable because it has a Cronbach's alpha value (0.81) greater than 0.7 (Hair et al., 2010; George and Mallery, 2011). SMCs and SFLs of all the items are greater than or close to 0.3 and 0.5. These results provide satisfactory evidence for high reliability and convergent validity of the co-alignment model.

6.2.4 Discriminant validity

Discriminant validity measures the extent to which a construct is truly distinct from other constructs in terms of how much it correlates with others and how distinctly measured variables represent only a single construct (Hair et al., 2010). In other words, it tests whether the indicators of the constructs are different enough, making it possible to conclude that they are measured as separate constructs (Holmes-Smith, 2011). It ensures that the construct is unique and captures some phenomena that other measures do not (Hair et al., 2010).

Discriminant validity can be ascertained using chi-square difference test and AVE methods (Hair et al., 2010; Holmes-Smith, 2011). Chi-square difference test is a more rigorous and widely accepted SEM based method of measuring discriminant validity (Holmes-Smith, 2011). It compares chi-square of constrained and unconstrained models and if the results are significantly different then it can be concluded that the instrument has high discriminant validity (Hair et al., 2010; Holmes-Smith, 2011). Discriminant validity of the co-alignment model was established using chi-square difference test as shown in Table 6.5.

Table 6-5: Assessment of discriminant validity of the structural model

Global business information requirement construct (GBIR)															
	MLIN			**MPIN**			**ATIN**			**CIN**			**GBPIN**		
	Δ X^2	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**
MLIN	-	-													
MPIN	41.51	1.00	0.00	-	-										
ATIN	30.17	1.00	0.00	39.01	1.00	0.00	-	-							
CIN	21.06	1.00	0.00	31.72	1.00	0.00	35.55	1.00	0.00	-	-				
GBPIN	50.64	1.00	0.00	57.08	1.00	0.00	67.02	1.00	0.00	53.86	1.00	0.00	-	-	
GSCIN	18.44	1.00	0.00	29.81	1.00	0.00	29.03	1.00	0.00	19.40	1.00	0.00	46.96	1.00	0.00
ERP systems capabilities construct (ERPSC)															
	SMLIN			**SMPIN**			**DATIN**			**DCIN**			**IGBPIN**		
	Δ X^2	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**
SMLIN	-	-													
SMPIN	30.42	1.00	0.00	-	-										
DATIN	35.58	1.00	0.00	34.22	1.00	0.00	-	-							
DCIN	26.43	1.00	0.00	23.25	1.00	0.00	29.60	1.00	0.00	-	-				
IGBPIN	50.45	1.00	0.00	49.11	1.00	0.00	51.42	1.00	0.00	38.71	1.00	0.00	-	-	
MGSCIN	26.31	1.00	0.00	27.63	1.00	0.00	29.23	1.00	0.00	20.02	1.00	0.00	39.66	1.00	0.00
Global business performance construct (GBPER)															
	FINP			**CUSP**			**LGP**			**IBPP**					
	Δ X^2	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**			
FINP	-	-													
CUSP	64.07	1.00	0.00	-	-										
LGP	48.30	1.00	0.00	56.72	1.00	0.00	-	-							
IBPP	60.35	1.00	0.00	62.39	1.00	0.00	52.90	1.00	0.00	-	-				
Co-alignment (structural) model															
	GBIR			**ERPSC**			**PER**								
	Δ X^2	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**	**Δ X^2**	**Δ DF**	**P**						
GBIR	-	-													
ERPSC	65.4	1.0	0.0	-	-										
GBPER	92.1	1.0	0.0	55.9	1.0	0.0	-	-							
Δ X^2	Difference in chi-square														
Δ DF	Difference in degree of freedom														
P	Probability														

Table 6.5 shows the results of discriminant validity for the main three constructs and the co-alignment model separately. The chi-square statistics of unconstrained models are significantly lower than the constrained models in all three constructs as well as in the co-alignment model. For example chi-square diffrence for GBIR and ERPSC in the co-alignment model is 65.4 with 1 degree of freedom difference. P-values of all the variables in the three main constructs and co-alignment model reach 0.00, indicating that these

constructs as well as the co-alignment model achieved sufficient discriminant validity (Hair et al., 2010; Holmes-Smith, 2011).

Standardised residual covariances of three main constructs concerning the final co-alignment model were also examined, in order to find whether there are any misspecifications in the final co-alignment model (see Appendix G). Appendix G shows that the standardised residual covariances of all the items in the three main constructs are within the acceptable range of ± 1.96 (at $\alpha = 0.05$ significance level), indicating that the final co-alignment has an acceptable fit.

6.3 The effect of moderator variables

This section discusses the effect of moderators in the research model. The moderator variable is a variable that can have an impact on the relationship between predictor variable and dependent variable (Venkatraman, 1989). Moderator variable can affect the direction and strength of the relationship between two related variables (Hair et al., 2010). For example, the relationship between two variables may be positive for one group and negative for another group, while the relationship between two variables may be strong for one group and weak for another (Hair et al., 2010). It is also important that the moderator variables be derived from the existing literature (Hair et al., 2010).

Moderator variables investigated in this research are organisation size and globalisation history. As discussed in the literature review (Chapter 2) these variables were drawn from extant literature. It is hypothesized that the moderator variables, organization size and globalization history, will have an impact on global business performance (financial, customer, learning and growth and internal business process). It predicts that the co-alignment of global business information requirements and ERP systems capabilities could have a different impact on large, small, established and new global organisations.

Moderator variables are generally having an impact on structural model estimates (Hair et al., 2010). Moderator variables proposed in this research are categorical in nature. Hence, multi-group confirmatory factor analysis (MGCFA) (Cheung and Rensvold, 2009; Dawn, 2010; Hair et al., 2010; Tallon and Pinsonneault, 2011) is used to test the effect of moderator variables. MGCFA involves the testing of invariance of estimated parameters of two nested models across groups (Cheung and Rensvold, 2009). Testing of measurement invariance is very important to determine whether the items used in the survey instruments mean the same things to members of different groups (Cheung and Rensvold, 2009). MGCFA is particularly important for cross-cultural research (Cheung and Rensvold, 2009). MGCFA was established using Hair et al. (2010) 3 step process.

Step 1: Configural invariance (totally free multi-group model (TF))

The configural invariance refers to the examination of whether the same item is an indicator of the same latent factor in each group, although the factor loadings might differ among the groups (Al-Qeisi, 2009). It involves establishing a similar basic structure in all groups. TF model estimates all free parameters separately. Therefore, it is free to take on different values in each group and the TF model becomes the baseline model for comparison.

Step 2: Metric invariance (constrained model)

The assessment of metric invariance is a step further from the configural invariance and refers to whether the loadings of each item on the underlying factor are equal among the groups (identical unit of measurement) (Al-Qeisi, 2009). Therefore, in this model all factor loadings (except those fixed to one) are constrained to be equal across the groups. The chi-square difference (ΔX^2) is computed between the constrained model and the TF model with the degrees of freedom equalling the number of constraints loading estimates across the groups.

Step 3: Comparison of results

The third stage involves comparison of the differences between TF model and constrained model. Comparison of path estimates (Tallon and Pinsonneault, 2011), chi-square difference test (ΔX^2) (Cheung and Rensvold, 2009; Hair et al., 2010), change in GOF statistics (Cheung and Rensvold, 2009; Hair et al., 2010), and effect size (Karim et al., 2007) are used to identify model invariances. If model fit statistics decrease significantly when the estimates are constrained, then it indicates that the path estimates are different and moderation does exist. If the model fit statistics are not significantly different, then there is no support for moderation.

Moderator variables of this research were investigated using multi-group confirmatory factor analysis. This research examines path estimates, chi-square difference, change in GOF statistics and effect size to evaluate measurement invariance of moderator variables. The following section discusses the MGCFA of organisation size variable followed by MGCFA of globalisation history variable.

6.3.1 MGCFA of moderator variable - organisation size

As discussed in the data cleaning and demographic statistics (chapter 4) organisation size can be determined using annual turnover and number of employees. Based on size organisations can generally be classified as small, medium and large (Pita, 2007). Although the multi-group confirmatory factor analysis required to have a large sample size (Ifinedo, 2008), one group (small organisations) in the sample had only 8 responses. Therefore, for analysing the impact of moderator variable of organisation size, small organisations also included in the medium category. For the purpose of multi-group confirmatory factor analysis, participating organisations were classified into two main categories: medium and large. Accordingly, the sample is divided into 98 large and 98 medium organisations. The model fit statistics and path coefficient of the TF and constrained models were estimated using multi-group confirmatory factor analysis. The path diagram for the TF and constrained models are included in Appendices H.2 and H.3.

As shown in Appendices H.2 and H.3, the TF model estimates an identical structural model in both groups, medium and large, simultaneously. In the constrained model, path estimates are constrained to be equal in medium and large groups. The results of MGCFA (path coefficient and model fit statistics) are discussed below.

6.3.1.1 Path coefficient of moderator variable - organisation size

Statistical significance of the moderator variables were measured using path coefficient of the structural relationship (co-alignment and global business performance) for each moderator variable. Path coefficients and critical ratios for moderator variable of organisation size (large and medium) are presented in Table 6.6.

Table 6-6: Path coefficients and critical ratios - organisation size

Paths		Large		Medium		Difference
		Path coefficient	C.R.	Path coefficient	C.R.	Path coefficient
Performance	Overall	0.77	6.404 ***	0.82	6.142 ***	(0.05)
	Financial	1.00	5.020 ***	0.96	5.020 ***	0.04
	Customer	0.98	5.020 ***	0.89	3.949 ***	0.09
	Learning & Growth	0.99	7.501 ***	0.92	6.634 ***	0.07
	Internal business process	0.98	8.557 ***	0.88	5.987 ***	0.10

Note : *** p< 0. 001 (two -tailed)

Table 6.6 indicates that all paths are significant (ranging from 0.77 to 1.00) for both large and medium organisations. However, path coefficients between co-alignment and financial, customer, learning and growth and internal business process performance of large global organisations (1.00/0.98/0.99/0.98) are greater than the medium global organisations (0.96/0.89/0.92/0.88). On the other hand, overall path coefficient is higher in medium global organisations than in large global organisations; however, path coefficients are not significantly different for both. This indicates that the co-alignment of global business information requirements and ERP systems capabilities deliver better performance in financial, customer, learning and growth and internal business processes for large global organisations than medium-sized ones. It also shows that global business issues are the same for medium and large organisations.

6.3.1.2 Model fit statistics of moderator variable - organisation size

Model fit statistics of TF model and constrained model are presented in Table 6.7.

Table 6-7: Model fit statistics

Model fit statistics	TF Model	Constrained model	Difference
Chi-square	3,795	3,871	76
DF	2,510	2,559	49
Normed chi-square	1.512	1.513	0.001
Bootstrap p	0.945	0.940	(0.005)
CFI	0.861	0.858	(0.003)
SRMR	0.065	0.072	0.007
RMSEA	0.051	0.051	-
PCLOSE	0.246	0.237	(0.009)

The model fit statistics shown in Table 6.7 indicate that the TF model and constrained model achieved an acceptable fit. Normed chi-square (1.512/1.513), P- value (0.95/0.94), SRMR (0.065/0.072), RMSEA (0.051/0.051) and PCLOSE (0.246/0.237) are within the accepted thresholds. However, constrained model achieved lower GOF statistics than TF model. The chi-square difference (ΔX^2) between TF model and constrained model is 76 with 49 degrees of freedom. This is not significant ($p = 0.007 > 0.001$), indicating that constraining path estimates are equal across medium and large global organisations do not produce a worse fit. Therefore, TF (unconstrained) model in which path estimates are freely estimated across the groups is not supported. The next section discusses the multi-group confirmatory factor analysis for the moderator variable globalisation history.

6.3.2 MGCFA of moderator variable - globalisation history

The descriptive frequencies for globalisation history suggest that the responding organisations can be classified into two main categories: established global organisations (over 15 years of global experience) and new global organisations (less than 15 years of global experience). Thus, the sample is divided into 114 established and 82 new global organisations. The model fit statistics and path coefficients of TF model and constrained model of globalisation history variable were estimated using multi-group confirmatory factor analysis. Path diagram of TF model and constrained model are shown in Appendices H4 and H5. TF model estimates an identical structural model in both groups, established and new, simultaneously. In the constrained model, path estimates are constrained to be equal in both groups. The results of path coefficient and model fit statistics are discussed below.

6.3.2.1 Path coefficient of moderator variable - globalisation history

The statistical significance of the globalisation history variable was measured using path coefficient of the structural relationship (co-alignment and global business performance). The results of path coefficients and critical ratios of moderator variable of globalisation history (established and new) are presented in Table 6.8.

Table 6-8: Path coefficients and critical ratios - globalisation history

Paths		**Established**		**New**		**Difference**
		Path coefficient	C.R.	Path coefficient	C.R.	Path coefficient
Performance	Overall	0.83	7.255 ***	0.75	5.035 ***	(0.08)
	Financial	1.00	6.062 ***	0.94	6.062 ***	(0.06)
	Customer	0.99	6.062 ***	0.91	3.556 ***	(0.08)
	Learning & Growth	1.00	8.609 ***	0.88	5.923 ***	(0.12)
	Internal business process	0.97	8.998 ***	0.88	5.600***	(0.09)

Note : *** p< 0. 001 (two -tailed)

Table 6.8 shows that the path coefficients between co-alignment and financial, customer, learning and growth and internal business process (1.0/0.99/1.0/0.97) performance of established global organisations are greater than in new ones (0.94/0.91/0.88/0.88). Furthermore, organisations with a long globalisation history achieve better overall business performance than organisations that are relatively new. These results indicate that the co-alignment of global business information requirements and ERP systems capabilities deliver better financial, customer, learning and growth and internal business process performance for organisations with long globalisation history than more recent ones.

6.3.2.2 Model fit statistics of moderator variable - globalisation history

Model fit statistics of the TF and constrained models are presented in Table 6.9.

Table 6-9: Model fit statistics

Model fit statistics	**TF Model**	**Constrained model**	**Difference**
Chi-square	3,808	3,890	83
DF	2,510	2,556	46
Normed chi-square	1.517	1.522	0.005
Bootstrap p	0.905	0.896	(0.009)
CFI	0.859	0.855	(0.004)
SRMR	0.072	0.075	0.003
RMSEA	0.052	0.052	-
PCLOSE	0.209	0.185	(0.024)

Table 6.9 indicates that both models, TF model and constrained model, are acceptable. Normed chi-square (1.517/1.522), p- value (0.905/0.896), SRMR (0.072/0.075), RMSEA (0.052/0.052) and PCLOSE (0.209/0.185) are within the accepted thresholds. However, constrained model achieves lower GOF statistics than TF model. The chi-square difference (Δ X^2) between the TF model and constrained model is 83 with 46 degrees of freedom. This is significant ($p = 0.0007 < 0.001$), indicating that constraining path estimates across established and new global organisations deliver poor model fit statistics. Therefore, TF (unconstrained) model in which path estimates are freely estimated across the groups is supported. The next section discusses effect size of the moderator variables.

6.3.3 Effect size - Moderator variables

The impact of moderator variables can also be determined by calculating the variation in R-square (R^2) or effect size of the moderator variables (Karim et al., 2007). The effect size is a gauge that can be used to measure the change in the outcome caused by the treatment of interest (Chin, 1998; Rice, 2009). The effect size (f^2) of organisation size moderator variable can be calculated as:

$$f^2 = \frac{R^2 \text{ large} - R^2 \text{ medium}}{1 - R^2 \text{ large}}$$

The effect size indicator (f^2) of 0.02 - small, 0.15 - medium and 0.35 - large can be used to determine whether the moderator variable has a small, medium or large effect on the dependent variable (business performance) (Chin, 1998). As shown in the above formula, the effect size of the moderator variable of organisation size is determined by comparing the difference between R^2 of large and medium-sized global businesses. Similarly, the effect size of the globalisation history moderator variable is determined using the following formula.

$$f^2 = \frac{R^2 \text{ established} - R^2 \text{ new}}{1 - R^2 \text{ established}}$$

The results of the effect size of the moderator variables, organisation size and globalization history, are presented in Table 6.10.

Table 6-10: Effect size of the moderator variables

Moderator Variable	**Organisation size**		**Globalisation history**	
	Large	**Medium**	**Estb.**	**New**
R-square (R^2)	0.59	0.67	0.69	0.56
Effect size (f^2)	**0.24 (Medium - Large)**		**0.42 (Large)**	

Table 6.10 indicates that the effect size of the organisation size moderator variable is in the range of medium to large (0.24) while globalisation history has a large effect size (0.42). This demonstrates that both organisation size and globalisation history moderate the relationship between co-alignment and global business performance. Organisation size has a medium to large effect on global business performance and globalisation history has a large impact on global business performance.

6.3.4 A summary of results from MGCFA of moderator variables

The effect of moderator variables on global business performance was analysed using multi-group confirmatory factor analysis. This section summarises the results of MGCFA of moderator variables as discussed in the preceding section. Path estimates, chi-square difference test, change in GOF statistics and effect size were examined to evaluate measurement invariance of moderator variables. The summarised results of each of these tests are discussed below.

Analysis of path estimates indicates that the path coefficients between co-alignment and financial, customer, learning and growth and internal business process performance of large global organisations (1.00/ 0.98/ 0.99/0.98) are greater than those concerning medium global entities (0.96/0.89/0.92/0.88). Similarly, path coefficients between co-alignment and financial, customer, learning and growth and internal business process performance (1.00/0.99/1.00/0.97) for established global organisations are greater than for new global organisations (0.94/0.91/0.88/0.88).

The comparison of GOF statistics indicated that the TF model achieves higher GOF statistics than the constrained model. The chi-square difference test revealed that the organisation size moderator variable is not significant ($p = 0.007 > 0.001$) whereas globalisation history is significant ($p = 0.0007 < 0.001$). The results of effect size indicate that moderator variable of organisation size has a medium to large effect (0.24) and globalisation history has a large effect (0.42).

The above results suggest that the financial, customer, learning and growth and internal business process performance for global organisations are moderated by both organisation size and globalisation history. Although the p-value of moderator variable of globalisation history exceeds the recommended value of 0.001, it has a medium to large effect size (0.24). Thus, the hypothesised moderator effect of organisation size (H_{7A}, $H_{7B,}$ H_{7C} and H_{7D}) and globalisation history (H_{8A}, $H_{8B,}$ H_{8C} and H_{8D}) are supported.

6.4 Hypotheses testing

This section discusses the results of hypotheses testing for the research study. Based on the extant literature fourteen (14) hypotheses were developed to achieve improved business performance by co-aligning global business information requirements with ERP systems capabilities. The results of statistical analysis for each hypothesis are presented in Table 6.11.

Table 6-11: Results of hypotheses testing

Hypothesis	Relationship			Predicted relationship	Path coefficient		C.R		P	Status
H_1	Co-alignment	--->	Financial performance	+	0.99		8.66		***	Supported
H_2	Co-alignment	--->	Customer performance	+	0.94		6.57		***	Supported
H_3	Co-alignment	--->	Learning & growth performance	+	0.96		8.66		***	Supported
H_4	Co-alignment	--->	Internal business process performance	+	0.93		8.30		***	Supported
H_5	Global business information requirements	--->	Global business performance	+	0.41		3.60		***	Supported
H_6	ERP systems capabilities	--->	Global business performance	+	0.50		4.20		***	Supported
The effect of moderators - Large vs small organisations										
Hypothesis	**Relationship**			**Predicted relationship**	**Path coefficient**		**C.R**		**P**	**Status**
					Large	**Medium**	**Large**	**Small**		
H_{7A}	Organisation size	--->	Financial performance	+	1.00	0.96	5.02	5.02	***	Supported
H_{7B}	Organisation size	--->	Customer performance	+	0.98	0.89	5.02	3.95	***	Supported
H_{7C}	Organisation size	--->	Learning & growth performance	+	0.99	0.92	7.50	6.63	***	Supported
H_{7D}	Organisation size	--->	Internal business process performance	+	0.98	0.88	8.56	5.99	***	Supported
The effect of moderators - Established vs new organisations					**Estb:**	**New**	**Estb:**	**New**		
H_{8A}	Globalisation history	--->	Financial performance	+	1.00	0.94	6.06	6.06	***	Supported
H_{8B}	Globalisation history	--->	Customer performance	+	0.99	0.91	6.06	3.56	***	Supported
H_{8C}	Globalisation history	--->	Learning & growth performance	+	1.00	0.88	8.61	5.92	***	Supported
H_{8D}	Globalisation history	--->	Internal business process performance	+	0.97	0.88	9.00	5.60	***	Supported

Note : *** p< 0. 001 (two -tailed)

Table 6.11 shows that the hypotheses related to the co-alignment and global business performance (H_1, H_2, H_3 and H_4) were all supported with high standardised regression weights (0.99/0.94/0.96/0.93) and critical ratios (8.66/6.57/8.66/8.30). Probabilities of all these hypotheses are less than 0.001, indicating that there is a positive and highly significant relationship between co-alignment (global business information requirements and ERP systems capabilities) on financial performance (H_1), customer performance (H_2), learning and growth performance (H_3) and internal business process performance (H_4) of global organisations.

Hypothesis 5 was supported, indicating that there is a positive relationship between effective management of global business information requirements and global business performance. Hypothesis 6 was also supported indicating that if ERP systems adequately support global business information requirements, improved performance can be achieved. However, path coefficients between global business information requirements and global business performance (H_5), as well as ERP systems capabilities and global business performance (H_6) are weak (0.41/0.50) compared to the other paths of the model.

The hypothesized moderation effect of organisation size and financial performance (H_{7A}), customer performance (H_{7B}), learning and growth performance (H_{7C}) and internal business process performance (H_{7D}) are supported, indicating that these factors are moderated by organisation size. Results indicate that large global organisations can perform better in terms of financial, customer, learning and growth and internal business processes than medium-sized global organisations.

The hypothesized moderating relationship of globalisation history and financial performance (H_{8A}), customer performance (H_{8B}), learning and growth performance (H_{8C}) and internal business process performance (H_{8D}) are also supported. This indicates that these factors are moderated by globalisation history. Organisations with a long globalisation history perform better in terms of financial, customer, learning and growth and internal business process than companies relatively new to globalisation.

6.5 Summary of findings

6.5.1 Global business

This research indicates that 80% of participating organisations have been operating globally for over 11 years. These organisations are from the Asia-Pacific region (82%), Europe (10%), the USA (6%), Africa (2%) and Latin America (1%). 10% of the responding organisations have 2-5 SBUs, 19% of them have 6-10 SBUs, 22% have 11-15 SBUs, 29% have 16-20 SBUs and the remaining 20% have over 21 SBUs. Responding organisations come from many industries including manufacturing and trading (51%), agriculture, forestry and fishing (12%), services (8%), gas and electricity (7%), communications (6%) and finance and insurance (5%) and are operating globally. It can be inferred that global business is a growing business trend.

6.5.2 Global business information requirements

Analysis of data presented in Chapter 5 indicates that global business information requirements constitute an important management requirement. This research confirmed that global supply chain information, accurate and timely information, consolidated information, multi-level information, multi-purpose information and global business process information are important for global business management.

6.5.3 ERP systems capabilities

29% of responses for this research indicate that ERP system is the most prevalent IS used to manage global business information requirements. It further identified the following capabilities of ERP systems are suitable for managing global business information requirements: transmitting secure information, delivering accurate and timely information, managing global supply chain information, delivering consolidated information, integrating global business process information, supporting multi-purpose information, and supporting multi-level information.

6.5.4 Global business performance

This research shows that improved financial, customer, learning and growth and internal business process outcomes are achieved if ERP systems capabilities are aligned with global business information requirements. Financial, customer, learning and growth and internal business process performance are the elements of balanced scorecard performance framework. Therefore, results suggest that the balanced scorecard is a good measure for evaluating the business performance of global organisations.

6.5.5 Organisation size and globalisation history

Data analysis of this research indicates that global organisations are generally large (50%) and medium (46%) sized businesses. Results indicate that large companies achieve better financial, customer, learning and growth and internal business process performance than medium-sized ones. Furthermore, data shows that 66% responding organisations have more than 15 years of global experience and 34% of responding organisations have less than 15 years. Results indicate established global organisations achieve better financial, customer, learning and growth and internal business process performance than new ones.

6.5.6 Co-alignment

This research used Venkatraman's (1989) co-alignment/co-variation theory to determine the impact of aligning ERP systems capabilities to global business information requirements for improved global business performance. Results indicate if these two constructs are effectively aligned, then improved global business performance (R^2/SMC = 0.63) can be achieved.

6.6 Summary

The chapter presented the results of the structural model validation and hypotheses testing. Sections 6.1 analysed structural relationships: co-alignment relationship and direct effect relationship of this research. It also presented a comparison of the results of the direct effect and co-alignment models. Based on the results the direct effect model was rejected in favour of a more parsimonious co-alignment model. The assessments of reliability, convergent validity and discriminant validity of the co-alignment model were presented in section 6.2. The effects of moderator variables, organisation size and globalisation history were investigated using multi-group confirmatory factor analysis (MGCFA) (section 6.3). MGCFA results suggest that the financial, customer, learning and growth and internal business process performance of global organisations are moderated by both organisation size and globalisation history.

The final section presents the results of hypotheses testing. The results confirmed that all hypotheses were statistically significant at a 99% confidence interval and confirmed the direction of their relationship as hypothesised. Results supported the main research proposition that global organisations can achieve improved business performance by co-aligning ERP systems capabilities to their information requirements. The impact of co-alignment on financial, customer, learning and growth and internal business process performance is positive and significant. However, path coefficients of hypotheses related to the direct effect relationship (model) are weak compared to the path coefficients of hypotheses of the co-alignment model.

CHAPTER 7. DISCUSSION

7.1 Introduction

This thesis established the impact of co-aligning ERP systems capabilities and global business information requirements on global business performance. This research proves that the co-alignment of ERP systems capabilities and global business information requirements positively influence global business performance. It addresses an important research issue on the co-alignment of ERP systems capabilities with global business information requirements for improved performance outcomes. It extends theories of IT/IS alignment, ERP systems, information management and business performance. This chapter discusses the key findings of this PHD research. The chapter starts with a discussion of descriptive findings. Then, it proceeds to discusses the proposed alignment models (co-alignment model and direct effect model), impact of moderator variables and hypotheses validation.

7.2 Discussion of descriptive findings

The key objective of this research is to investigate the impact of co-alignment of global business information requirements and ERP systems capabilities on business performance of global organisations. Business performance was measured using fourteen different items: increased return on investment, increased sales revenue, reduced operational costs, enhanced company image, increased customer satisfaction, improved supplier relationship management, enhanced market share, improved innovation capabilities, enhanced employee satisfaction, improved operational efficiency, better inventory management, quality and productivity improvement and reduction in waste. Table 7.1 presents the views of the respondents about the global business information requirements, ERP systems capabilities and global business performance. The significance/importance of these variables is determined using standardised factor loadings of the final measurement model. A single star (*) represents not significant, two stars (**) represent somewhat significant, three stars (***) indicate significant and four stars (****) represent highly significant.

Table 7-1 : Descriptive findings

Construct	Variable	Ranking	Significance
Global business information requirements	Global supply chain information	1	****
	Accurate and timely information	2	****
	Consolidated information	3	****
	Multi-level information	4	****
	Multi-purpose information	5	****
	Global business process information	6	***
	Secure information	7	*
ERP system capabilities	Able to transmit secure information	1	****
	Deliver accurate and timely information	2	****
	Manage global supply chain information	3	****
	Provide consolidated information	4	****
	Integrate global business process information	5	***
	Support multi-purpose information	6	****
	Support multi-level information	7	****
Global business performance	Improved operational efficiency	1	****
	Improved quality of products and services	2	****
	Reduced operational costs	3	***
	Enhanced employee satisfaction	4	****
	Increased sales revenue	5	****
	Reduction in waste	6	****
	Increased return on investment	7	****
	Improved organizational productivity	8	****
	Improved innovation capabilities	9	****
	Increased customer satisfaction	10	****
	Improved supplier relationship management	11	**
	Enhanced market share	12	***
	Enhanced company image/reputation	13	**
	Better inventory management	14	****

The survey data supported the findings in the literature. Table 7.1 indicates that the global business information requirements identified from the extant literature are significantly important (except secure information and global business process information) for managing business operations of global organisations. Global supply chain information, accurate and timely information and consolidate information were the highest-ranking global business information requirements. Secure information and global business process information were the least important requirement.

The findings also revealed that ERP systems have capabilities to support information requirements of global businesses. They are also highly significant except integrating global business process information. Transmission of secure information, delivering accurate and timely information and managing global supply chain information were the top ranking ERP systems capabilities. Supporting multi-level and multi-purpose information were the lowest ranking ERP systems capabilities.

Furthermore, the findings revealed that the co-alignment of global business information requirements and ERP systems capabilities deliver improved business performance. Out of 14 items, 10 were highly significant, 2 were significant and the balance 2 items were somewhat significant. The highest-ranking performance categories were improved operational efficiency, improved quality of products and services, reduced operational cost, enhanced employee satisfaction and increased sales revenue. The lowest ranking performance category was the better inventory management.

7.3 Global business

The findings discussed in Chapter 6 confirm that global business is a growing business trend in this decade. Organisations that responded to the survey were truly global with the number of countries in which they operated ranging from 2 to greater than 25, although most businesses participating in this research were from the Asia-Pacific region (82%). This finding confirms Bharadwaj et al.'s (2010) opinion that global organisations in the Asia Pacific are wide. Other regions including Europe (10%), the USA (6%), Africa (2%) and Latin America (1%) also had some representation indicating the growth of global businesses in these regions.

Industries that participated in this research include manufacturing and trading (51%) agriculture, forestry and fishing (12%), services (8%), gas and electricity (7%), communications (6%), finance and insurance (5%), construction (4%) and mining (3%). This finding confirms Arnold et al.'s (2010) suggestion that the manufacturing and trading industries are generally operating globally. Other industries such as agriculture, forestry and fishing, services, gas and electricity, communications, finance and insurance, and construction and mining have also started moving to the global arena.

7.4 Global business information requirements

Managing global business operations is complex, expensive and challenging (Carter, 2010), and global businesses have unique information requirements (Ghosh, 2002; Buckley and Casson, 2009; Koren, 2010). This research identified global business information requirements that are important for global business management. Table 7.2 presents the findings.

Table 7-2: Global business information requirements

Global Business Information Requirements	Reference	Research Findings			
		SMC	SFL	C.R	P
Global supply chain information	kimble, 2011; Friedman, 2006; Koren, 2010; Turban et al., 2010; Hill, 2011	0.98	0.99	7.745	***
Accurate and timely information	Peppard, 1999; Ghosh, 2003; Hawking, 2008; Mishra, 2009; SAP AG, 2009; Koren, 2010; Hill, 2011	0.97	0.99	7.302	***
Consolidated information	SAP AG, 2004; Mishra, 2009; Hill, 2011	0.97	0.99	7.829	***
Multi-level information	Grant, 2003; Chhai and Lan, 2005; Power and Sharda, 2009	0.92	0.96	7.344	***
Multi-purpose information	Grant, 2003; Kumar et al., 2008; Power and Sharda, 2009; SAP AG, 2009	0.84	0.91	7.275	***
Global business process information	Peppard, 1999; Koren, 2010; Sannarnes, 2010	0.39	0.62	7.745	***
Secure information	Kajava et al., 2006; Luftman and Kempaiah, 2008; Hitachi Consulting, 2009; Laudon and Laudon, 2010	0.03	0.16	1.239	0.215

Note : *** p< 0. 001 (two -tailed)

Data presented in Table 7.2 indicates that SMC, SFL and CR for six (global supply chain information, accurate and timely information, consolidated information, multi-level information, multi-purpose information and global business process information) of the seven global business information requirements are significant.

7.5 ERP systems capabilities

Global businesses have invested heavily in ERP systems to support their worldwide operations (D'Aquila et al., 2009; Koumpis and Protogeros, 2010). This research confirmed that the global businesses used ERP systems for managing their information requirements and identified those capabilities of ERP systems that were important for global business information management. The findings are presented in Table 7.3.

Table 7-3: ERP systems capabilities

ERP System Capabilities	Reference	Research Findings			
		SMC	SFL	C.R	P
Transmit secure information	Smets-Solanes and De Carvalho, 2003; Solms and Hertenberger, 2005; Laudon and Laudon, 2010	0.97	0.98	14.185	***
Deliver accurate and timely information	Sharif et al., 2005; Chand et al., 2005; Beheshti, 2006; Seddon et al., 2010	0.97	0.98	7.878	***
Manage global supply chain information	Shew et al., 2003; Mabert et al., 2003; Beheshti, 2006	0.97	0.98	8.307	***
Deliver consolidate information from different units and processes	Seddon, 2005; BPP Learning Media, 2009b; Seddon et al., 2010	0.96	0.98	9.079	***
Support multi-purpose information	Siau, 2004, McGaughey and Gunasekaran, 2009; Subramoniam et al., 2009; Seddon et al., 2011	0.96	0.98	8.483	***
Support multi-level information	Sane, 2005; McGaughey and Gunasekaran, 2009; Subramoniam et al., 2009; Seddon et al., 2010	0.91	0.95	8.232	***
Integrate global business process information	Sane, 2005; Gunter and Andrea, 2009; Seddon et al., 2010	0.54	0.74	9.079	***

Data presented in Table 7.3 indicates that SMC, SFL and CR for the identified ERP systems capabilities are significant for global business information management.

7.6 The structural model

This research tested the alignment of ERP systems capabilities and global business information requirements for improved performance with two types of relationships, the co-alignment/co-variation relationship (model) and the direct effect relationship (model). Following section discusses the findings based on two types of relationships.

7.6.1 Co-alignment model

The co-alignment model (Figure 7.1) represents the conceptual relationship (co-alignment relationship) among three main constructs, GBIR, ERPSC and GBPER. Figure 7.1 depicts the co-alignment model with the statistical results.

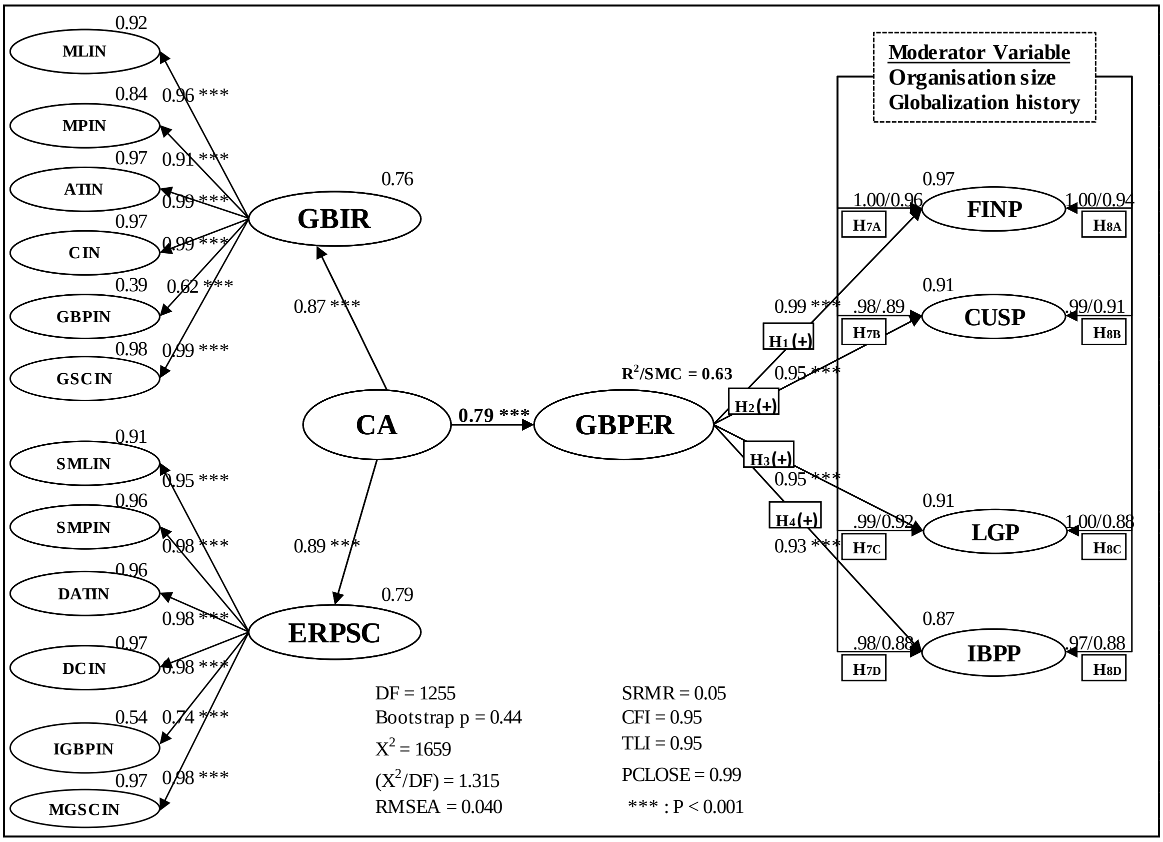


Figure 7-1: Co-alignment model

As shown in Figure 7.1, co-alignment is a third order construct derived from two second order constructs namely global business information requirements and ERP systems capabilities. The findings supported the co-alignment model indicating that the co-alignment of global business information requirements with ERP systems capabilities delivers improved global business performance. This model achieves an acceptable fit with normed chi-square (1.315) being within the accepted range between 1 and 2; RMSEA (0.040) well below the recommended threshold of 0.08; SRMR (0.05) well below the recommended threshold of 0.09; CFI (0.95) and TLI (0.95) well above the recommended threshold of 0.92 and PCLOSE (0.99) well above the recommended value of 0.05.

The co-alignment model explains that 63% (SMC/R^2) of the global business performance was achieved when global business information requirements were aligned to ERP systems capabilities. Observed variables of all three constructs (GBIR, ERPSC and GBPER) are approximately the same, indicating that they are parallel measures of those constructs (Holmes-Smith, 2011). Furthermore, results suggest that all three latent constructs (GBIR, ERPSC and GBPER) account for about 90% of the variance in many of the indicators. This indicates that they are good measures for those constructs (Holmes-Smith, 2011). These findings confirm that if ERP systems capabilities are aligned to global business information requirements, better global business performance will follow. The next section discusses the results of the direct effect model.

7.6.2 Direct effect model

Based on Venkatraman's (1989) and Croteau and Raymond's (2004) suggestion a rival model (direct effect model) was developed and tested with the same set of data to establish other relationships (rival hypotheses) between the constructs. The direct effect model argues that there are direct causal links between global business information requirements and global business performance, as well as ERP systems capabilities and global business performance, without the influence of co-alignment. This model is presented in Figure 7.2.

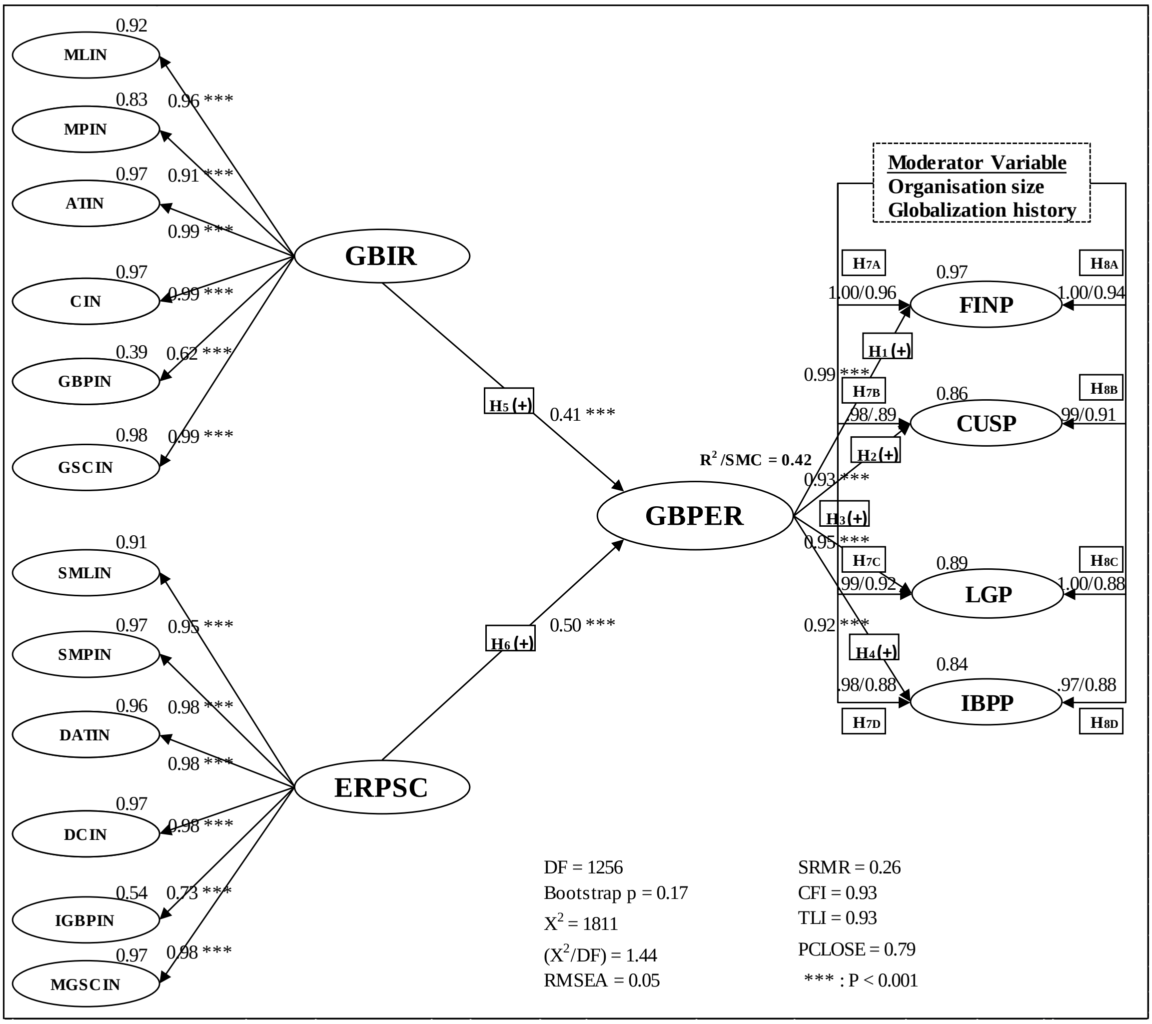


Figure 7-2: Direct effect model

As shown in Figure 7.2 the direct effect model achieves an acceptable fit (Hair et al., 2010) with normed chi-square (1.44) being within the accepted range between 1 and 2; RMSEA (0.05) well below the recommended threshold of 0.08; CFI (0.93) and TLI (0.93) slightly above the recommended threshold of 0.92 and PCLOSE (0.79) well above the recommended threshold of 0.05. However, some of the fit statistics (SRMR (0.26), AGFI (0.73) and RFI (0.79)) are outside the accepted thresholds of 0.92, 0.90 and 0.92 (Hair et al., 2010). Direct effect model explains 42% of the global business performance outcomes. This clearly is less than the 63% of the global business performance outcomes explained in the co-alignment model (Figure 7.1). The following section compares the results for the direct effect and co-alignment models.

7.6.3 Comparison of the direct effect model and co-alignment model

Comparing the results for the direct effect and co-alignment models illustrate that the direct effect model explains 21% less variance (R^2 = 0.42 vs 0.63) in global business performance. Goodness of fit of the direct effect model is less than the co-alignment model (p-value = 0.17 vs 0.44, RMSEA = 0.048 vs 0.040, SRMR = 0.26 vs 0.05, CFI = 0.93 vs 0.95, TLI = 0.93 vs 0.95 and PCLOSE = 0.79 vs .99). Correlations between GBIR and CA/GBPER and ERPSC and CA/GBPER of direct effect model is also weaker (path co-efficient 0.41 and 0.50 vs 0.87 and 0.89) than the co-alignment model. Therefore, the direct effect model (Figure 7.2) is rejected in favour of a more parsimonious co-alignment model (Figure 7.1) as suggested by Croteau and Raymond (2004) and Croteau et al. (2001).

The co-alignment model achieves a high reliability, convergent validity (Table 6.4) and discriminant validity (Table 6.5). Cronbach's alpha, co-efficient Hs and average variance extracted (AVEs) of all the variables are higher than the recommended thresholds of 0.7, 0.7 and 0.5 (Hair et al., 2010; Holmes-Smith, 2011). Chi-square difference test also reveal that the co-alignment model achieved sufficient discriminant validity (p-value 0.00). This finding suggests that global business performance is a direct outcome of ERP systems capabilities being aligned to global business information requirements.

7.7 Impact of organisation size and globalisation history on global business performance

This section discusses the impact of organisation size and globalisation history on global business performance. Literature indicates that the organisation size (Sedera et al., 2003; Batenburg and Constantiou, 2009) and globalisation history (Kim and Oh, 2000) moderate the global business performance.

The MGCFA indicates that the organisation size moderates the relationship between co-alignment and global business performance. Path coefficient analysis indicates that large global organisations achieved better financial, customer, learning and growth and internal business process performance than small global organisations. The chi-square different test revealed that the moderator variable of organisation size is not significant (p = 0.007 more than 0.001). However, the results of effect size indicate that moderator variable of organisation size has a medium to large effect (0.24). Thus, it is concluded that the financial, customer, learning and growth and internal business process performance of global organisations are moderated by organisation size. Although it is assumed that large organisations would be in a better position to allocate resources than medium scale global organisations, this research did not explore this aspect. This would be an important future research issue.

The MGCFA of revealed that the globalisation history moderates the relationship between co-alignment and global business performance. Path coefficient analysis indicate that the co-alignment of global business information requirements with ERP systems capabilities result in better financial, customer, learning and growth and internal business process performance for organisations with a longer globalisation history than the newly established organisations. The chi-square different test revealed that the moderator variable of globalisation history is significant (p = 0.0007 less than 0.001). The results of effect size indicate that moderator variable of globalisation history has a large effect (0.42) on global business performance. These results confirmed that the financial, customer, learning and growth and internal business process performance of global organisations are moderated by globalisation history. However, why globalisation history has a positive impact on business performance has not been investigated in this research and would constitute a valid subject of further research.

7.8 Global business performance

The key objective of this research was to investigate the impact of aligning ERP systems capabilities and global business information requirements on global business performance. Earlier IT/IS alignment studies indicate the alignment of IT/IS to business delivers improved business performance (Chan et al., 1997; Dong et al., 2008). This research is the first to align ERP systems capabilities with global business information requirements for improved global business performance. This research also confirmed that balanced scorecard is a useful framework to measure global business performance.

Findings revealed that improved financial, customer, learning and growth and internal business process performance in global organisations is achieved by using ERP systems for information management. This research (R^2/SMC = 63%) extends Croteau et al.'s (2001) and Croteau and Raymond's (2004) studies on the alignment of organisational and technological infrastructure, and strategic and IT competencies for improved performance (R^2/SMC = 37% and 24% respectively). Overall, the contribution this research makes is that if ERP systems capabilities are co-aligned with global business information requirements, improved global business performance results. This research also extends Venkatraman's (1989) conceptualisation of fit as co-alignment/co-variation to the alignment of ERP systems and global business information requirements.

7.9 Hypotheses validation

This section discusses the results of hypotheses validation. Table 7.4 shows the path coefficients, p-vales and the outcome of the hypotheses testing derived from SEM analysis.

Table 7-4: Results of hypotheses testing

Hypothesis		**Path coefficient**		**P**	**Results**
H_1	The co-alignment between global business information requirements and ERP system capabilities positively influence financial performance of global businesses	0.99		***	Supported
H_2	The co-alignment between global business information requirements and ERP system capabilities positively influence customer performance of global businesses	0.94		***	Supported
H_3	The co-alignment between global business information requirements and ERP system capabilities positively influence learning and growth performance of global businesses	0.93		***	Supported
H_4	The co-alignment between global business information requirements and ERP system capabilities positively influence internal business process performance of global businesses	0.96		***	Supported
H_5	If global business information requirements are effectively managed, improved performance will be achieved.	0.41		***	Supported
H_6	If ERP systems adequately support global business information requirements, improved performance will be achieved.	0.50		***	Supported
The effect of moderators - Large vs small organisations		**Large**	**Medium**		
H_{7A}	Financial performance of global businesses is moderated by organisation size	1.00	0.96	***	Supported
H_{7B}	Customer performance of global businesses is moderated by organisation size	0.98	0.89	***	Supported
H_{7C}	Learning & growth performance of global businesses is moderated by organisation size	0.99	0.92	***	Supported
H_{7D}	Internal business process performance of global businesses is moderated by organisation size	0.98	0.88	***	Supported
The effect of moderators - Established vs new organisations		**Estb:**	**New**		
H_{8A}	Financial performance of global businesses is moderated by globalization history	1.00	0.94	***	Supported
H_{8B}	Customer performance of global businesses is moderated by globalization history	0.99	0.91	***	Supported
H_{8C}	Learning & growth performance of global businesses is moderated by globalization history	1.00	0.88	***	Supported
H_{8D}	Internal business process performance of global businesses is moderated by globalization history	0.97	0.88	***	Supported

Note : *** p< 0. 001 (two -tailed)

The SEM analysis of data in this research proves that all hypotheses are supported with a 99% confidence level, however, path coefficient (hypothesized relationship) between global business information requirements and global business performance (H_5), as well as ERP systems capabilities and global business performance (H_6) are weak (0.41/0.50) compared to the paths in the co-alignment model (Figure 7.1). Results support existing literature (Venkatraman, 1989, 1990; Croteau and Raymond, 2004), confirming that the direct effect model explains less variance in global business performance and path significance of the rival hypotheses are weaker than the path significance of the hypotheses in the co-alignment model. This finding highlights the importance of aligning global business information requirements with ERP systems capabilities.

Hypotheses related to the moderator variable of organisation size are supported indicating that the organisation size moderates the relationship between co-alignment and financial performance (H_{7A}), customer performance (H_{7B}), learning and growth performance (H_{7C}) and internal business process performance (H_{7D}) of global organisations. Therefore, if an organisation is large, they tend to achieve better business performance than medium scale ones, from aligning global business information requirements with ERP systems capabilities.

Hypotheses related to the moderator variable of globalisation history are also supported, indicating that globalisation history moderates the relationship between co-alignment and financial performance (H_{8A}), customer performance (H_{8B}), learning and growth performance (H_{8C}) and internal business process performance (H_{8D}) of global organisations suggesting that the longer an organisation has been operating globally, the better it aligns information requirements with ERP systems for improved performance.

7.10 Summary

Findings of this PHD research confirms that the co-alignment of global business information requirements and ERP systems capabilities leads to improved global business performance. The findings established that the global organisations have unique information requirements somewhat different to local businesses. These include multi-level information, multi-purpose information, accurate and timely information, consolidated information, global business process information and global supply chain information. ERP systems have capabilities that are suitable for supporting global business information requirements. These include supporting multi-level and multi-purpose information; delivering accurate, timely and consolidated information; integrating global business process information, managing global supply chain information and transmitting secure information.

Findings provide strong evidence that the co-alignment of global business information requirements with ERP systems capabilities improve financial, customer, learning and growth and internal business process performance of global organisations. Results also confirmed that financial, customer, learning and growth and internal business process performance of global organisations are moderated by organisation size and globalisation history.

CHAPTER 8. CONCLUSION AND FUTURE RESEARCH

8.1 Introduction

This chapter presents conclusion and future research issues. It begins with answering research questions. Then it discusses key findings and implications, highlights future research issues and contribution to knowledge.

8.2 Answers to the research questions

The objective of this PhD was to determine the alignment of ERP systems capabilities to global business information requirements for improved global business performance. To address this objective the research posed four research questions:

Primary research question:

1) Should ERP systems capabilities be aligned to global business information requirements for improved global business performance?

Sub research questions:

2) What are the information requirements of global organisations?

3) Which ERP systems capabilities are useful for managing global business information requirements?

4) To what extent can these ERP systems capabilities support global business information requirements?

8.2.1 What are the information requirements of global organisations?

The findings of the SEM analysis (Chapter 5) confirm that multi-level information, multi-purpose information, accurate and timely information, consolidated information, global business process information and global supply chain information are important global business information requirements. Although literature (Kajava et al., 2006; Solms and Hertenberger, 2005; Laudon and Laudon, 2010) emphasised on secure information transmission to be a requirement for global business, this research did not confirm this aspect of global business information requirement.

8.2.2 Which ERP systems capabilities are useful for managing global business information requirements?

This research confirms that supporting multi-level and multi-purpose information, accurate and timely information, consolidated information, integrated global business process information, global supply chain information and secure information are important ERP systems capabilities required for the management of global business.

8.2.3 To what extent can these ERP systems capabilities support global business information requirements?

Standardised factor loadings, squared multiple correlations, critical ratios and P-values, which where all significant (Table 7.2) confirm that ERP systems capabilities of handling multi-level and multi-purpose information, accurate and timely information, consolidated information, integrated global business process information, global supply chain information as well as secure information transmission are essential for global business information management.

8.2.4 Should ERP systems capabilities be aligned to global business information requirements for improved global business performance?

This research confirms that it is important to align ERP systems capabilities to global business information requirements. Findings reveal that global businesses can achieve improved financial, customer, learning and growth and internal business process performance by co-aligning their information requirements with ERP systems capabilities. The research model (Figure 7.1) explains that 63% (SMC/R^2) of the variance in global business performance is achieved by co-aligning ERP systems capabilities to global business information requirements. Research contributions are discussed in the next section.

8.3 Research contributions

This research makes a useful contribution to the field of information systems and global business. It established a set of information requirements for the management of global business operations. It extended the ERP systems literature by identifying a set of ERP systems capabilities specifically suitable for global business management. This research extends ERP systems theory to the global arena.

This research extends Venkatraman's (1989) co-alignment/co-variation theory to the alignment of ERP systems capabilities to global business information requirements for improved global business performance.

This research makes an important contribution to the global business information management literature, by identifying and validating a set of information requirements useful for managing global business operations.

This research also makes a contribution to the business performance literature by establishing the impact of aligning two constructs (ERP systems capabilities and global business information requirements) to achieve improvements in customer, financial, learning, business growth and business processes. It also suggests that the balanced scorecard is a useful framework for measuring global business performance.

From a practical point of view, this research highlights the importance of identifying specific information requirements for global organisations, and ERP systems capabilities required for managing these information requirements. Findings of this research indicate that information requirements should be aligned to ERP systems capabilities to achieve improved global business performance.

8.4 Limitations of this study

Bartlett and Ghoshal, (1998), argued that there are four main types of organisations operating in the global arena: international, multinational, transnational and global organisations with slightly different characteristics. However, in this research we considered all four categories as global organisations. Furthermore, data analysed in this research is mostly from the Asia-Pacific (82%) region, which somewhat hinders the generalisation of the research findings to other regions, and specific types of global operations.

8.5 Future research issues

Since this research referred to all categories of global businesses (international, multinational, transnational and global) as global businesses, information requirements for international, multinational, transnational and global organisations might be different due to their marketing strategy, management strategy, administrative structure, knowledge management and governance (Bartlett and Ghoshal, 1998; Hill, 2011). This can be explored further.

Extend this research to global businesses in other regions of the world.

This research found that the large global organisations achieve better business performance than medium size global organisations. This could be due to that the large organisations are in a better position to allocate resources than medium size organisations (McAdam and Reid, 2001). However, this research has not explored reasons for this discrepancy. Therefore, investigating the reasons for this could be a future research issue.

This research also found that organisations with a longer globalisation history perform better than new global organisations. However, why history has a positive impact on business performance was not explored in this study. This could be a further research issue.

This research did not confirm secure information transmission to be an important global business information requirement. Further research is required to understand why this was not the case.

8.6 Conclusion

This research developed and empirically tested the co-alignment of ERP systems capabilities to global business information requirements for improved business performance.

The findings of this thesis support the conceptualisation of fit as co-alignment/co-variation, confirming that the co-alignment of global business information requirements and ERP systems capabilities leads to improved global business performance. The findings established that global organisations have unique information requirements and ERP systems are capable of supporting these information requirements. This research clearly indicates that if IT system (ERP) capabilities are aligned with information requirements of global organisations, then improved business performance can be achieved. Improved business performance in this research includes increased customer satisfaction, improved financial outcomes, organisational learning, business growth and improved business processes.

Although the outcomes of this research are based on large and medium organisations, that were using ERP systems to support their global business operations, the findings are useful for the management of all global operations, which is a growing business trend.

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Appendices

Appendix A: IT/IS Alignment Models

IT/IS Alignment Model	Literature Source	Findings
Strategic Alignment Model (SAM) by Henderson and Venkatraman.	(Henderson and Venkatraman, 1993)	This well-known study explained the interrelationship between business and IT strategy. This model was introduced to replace the traditional functional linkage model of IT planning. The central aims of this model were to understand the potential of IT for tomorrow's organizations and to conceptualize and direct the emerging area of strategic management of information technology. It comprises four fundamental domains of strategic choice, namely (i) business strategy, (ii) organizational infrastructure and processes, (iii) IT strategy, and (iv) IT infrastructure and processes. According to this model, the concept of strategic alignment is based on two building blocks: (i) strategic fit, and (ii) functional integration. Strategic fit recognizes the need for addressing both internal and external domains. Functional integration addresses the link between business strategy and IT strategy. It suggests that effective management requires a balance between all four domains of the model. It also argues that IT should transcend its traditional back office functions and have a strategic role.
IS Strategic Alignment Model by Chan and Huff.	(Chan and Huff, 1993)	This model contains five fundamental constructs: (i) business strategy (ii) IS strategy (iii) IS strategic alignment (iv) IS effectiveness, and (v) business performance. It measured business strategic orientation, IS strategic orientation, and IS strategic alignment and then investigates their implications on perceived IS effectiveness and business performance. IS strategic alignment is determined as the fit between business strategic orientation and IS strategic orientation. This model adopted seven dimensions of strategic orientation of business enterprises, namely aggressiveness, analysis, defensiveness, futurity, innovativeness, pro-activeness and risk, introduced by (Venkatraman, 1989b). Then it determined the extent to which each of these dimensions influenced the company's information systems and business strategy. It revealed that the stronger the link between these dimensions, then the alignment becomes stronger and this contributes to improved IS and business performance.

IT/IS Alignment Model	Literature Source	Findings
Resource Based Alignment Model by Powell and Dent-Micallef.	(Powell and DentMicallef, 1997)	This model investigates the link between information technology and firm performance. It examines resource-based theoretical perspectives and results support the resource-based approach. It indicates that IT alone is not able to produce sustainable performance and shows why some firms struggle while others flourish with the same information technology resources. Integration of IT with the firm's infrastructure of human and business complementary resources is the solution to these issues. However, this study focuses only on the retail industry. Therefore, findings cannot be applied to more complex organizational settings such as global businesses or specific IT systems such as ERP.
Enablers and Inhibitors of Business IT Alignment by Luftman and Brier.	(Luftman and Brier, 1999)	This model introduced the six most frequent enablers: (i) senior executive support for IT (ii) IT involved in strategy development (iii) IT understands the business (iv) business/IT partnership (v) well-prioritized IT projects, and (vi) IT demonstrates leadership. The six most common inhibitors were also described: (i) IT/business lack close relationships (ii) IT does not prioritize well (iii) IT fails to meet its commitments (iv) IT does not understand business (v) senior executives do not support IT, and (vi) IT management lacks leadership of alignment. It addresses both how IT is aligned with business and how business should be aligned with IT. It concludes that achieving alignment is an evolutionary and dynamic process and executives should work towards maximizing enablers and minimizing inhibitors. The model focused on IT alignment in general and does not address alignment issues pertaining to any specific IT systems such as ERP or alignment issues in complex organizational settings such as global businesses.
Strategic Alignment Maturity Model by Luftman.	(Luftman, 2000)	This model defined five maturity levels viz: (i) an initial/ad hoc process (ii) committed process (iii) established focused process (iv) improved/managed process, and (v) optimized process. Each level is evaluated based on the following six criteria: (i) communications (ii) competency/value measurement (iii) governance (iv) partnership (v) scope and architecture, and (vi) skills. It provides a comprehensive overview of various characteristics of the different levels of alignment maturity. However, the focus of this model is on IT business alignment maturity and does not address alignment issues pertaining to specific IT

IT/IS Alignment Model	Literature Source	Findings
		systems such as ERP or complex organizational settings such as global businesses.
Social Dimension Alignment Model by Reich Benbasat.	(Reich and Benbasat, 2000)	This model examines the social dimension of alignment and includes four factors that would potentially influence alignment: (i) shared domain knowledge between business and IT executives (ii) IT implementation success (iii) communication between business and IT executives, and (iv) connections between business and IT planning. The primary purpose of this study was to understand the social dimensions of alignment. It mainly supports only for short-term strategic IT alignment. However, shared domain knowledge was found to influence long-term alignment and a new factor, strategic business planning, was found to influence both long- and short-term alignment. Since data was collected from companies in the insurance industry, extra caution is required in generalizing the findings to other industries.
Alignment Model by Sabherwal and Chan.	(Sabherwal and Chan, 2001)	This model examines the impact of alignment on perceived business performance using a combination of Miles and Snow's typology on business strategy classification, and Venkatraman's measure of business strategy. Business strategy types are: (i) defender, and (ii) analyser (iii) prospector. IS strategy types are: (i) IS for efficiency (ii) IS for flexibility, and (iii) IS for comprehensiveness. Results indicate that realized business strategy and realized IS strategy is important for achieving business success. The alignment improves business performance of prospectors and analysers but not of defenders. Even though this model mainly concentrates on IS strategy, alignment issues were not discussed in relation to specific IT systems such as ERP. Furthermore, it does not address the alignment issues in an organization operating in a cross-cultural framework such as a global business.
Strategic Alignment Maturity Model by Duffy.	(Duffy, 2002)	This model is composed of four maturity levels that can be used as a tool to help management align business and IT. The model is organized around six key success drivers: (i) HR organization and management (ii) innovation and renewal (iii) IT/business partnership (iv) IT/business architectures (v) operational excellence, and (vi) ROI strategy and management. It argues that in the maturity level one, there is a fundamental disconnect between technology executives and the rest of

IT/IS Alignment Model	Literature Source	Findings
		corporate management. Maturity level four implies that IT and business are inextricably entwined and there is only one single strategy that incorporates both business and IT. It discusses the characteristics of each maturity level but the model is silent on how to attain each of these levels. Further, it does not discuss the importance of alignment with respect to specific IT systems such as ERP or complex organizational settings such as global businesses.
Alignment Model by Chan, Sabherwal and Thatcher.	(Chan et al., 2006)	This model discusses antecedents and consequences of IT business alignment. Antecedents examined in this model are: (i) shared domain knowledge (ii) planning sophistication (iii) prior IS success (iv) environmental uncertainty, and (v) organizational size. It examines the alignment impact of these antecedents in different industries. Differences across defender, prospector, and analyser business strategies are also examined. It also found that strategic IS alignment improves organizational performance. Even though it discusses IT business alignment in general, it does not discuss alignment issues pertaining to specific IT systems such as ERP system. Furthermore, it does not address the alignment issues in complex organizational settings such as global businesses.
Alignment Model by Hu and Huang.	(Hu and Huang, 2006)	This study investigates how a strategic performance management tool - the balanced scorecard - can be used as a framework for aligning IT initiatives with business strategies. This study adopted Reich and Benbasat’s (2000) alignment model as an initial theoretical guide. Based on the findings the authors proposed modifications to the original alignment model of Reich and Benbasat. However, the focus of this study is mid-sized companies and not complex organizations such as global businesses.
Alignment Model by Anthony, Lewis and Bryan.	(Anthony Byrd et al., 2006)	This model tested the complementary relationship between strategic alignment and IT investment and its relationship with business performance. It consists of four variables. The first two variables focus on alignment in the planning process of business and IT (coordination and integration). The second two variables focus on the realized outcomes of alignment (matching and moderating). The study found that aligning IT and business strategies can increase revenues and profits

IT/IS Alignment Model	Literature Source	Findings
		without further investment in IT. Strategic alignment performs not as a direct contributor to firm performance but as a moderator between IT investment and firm performance. However, it does not address the alignment issues in complex organizations such as global businesses or specific IT systems such as ERP.

Appendix B: Survey

B.1. Survey Questionnaire

Aligning ERP Systems to Global Business Information Requirements

Thank you for your participation in this research project. This survey will take less than 20 minutes to complete.

Global business is a business that has cross boarder operations (global business operations) and transfers capital, finished goods, raw materials, services, information, knowledge and skills across national boundaries.

This survey aims to investigate whether improvements in the performance of global business can be achieved from effectively aligning ERP systems to business.

A summary of findings of the study will be available to you if you wish to have it.

Section A: Demographics

Please respond to the question by clicking on the option that best describes your organisation.

1) Does your organisation have global business operations?

☐ Yes ☐ No

2) Does your organisation have an ERP system?

☐ Yes ☐ No

If your answer for any of the above two questions is no, please proceed to the end of the questionnaire and click submit.

3) In how many countries does your organization have business operations?

☐ 2-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ > 25

4) How many strategic business units (SBUs) [1] does your organisation have globally?

☐ 2-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ > 25

5) In how many countries do you have these SBUs?

☐ 2-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ > 25

6) For how many years has your organisation been doing business globally?

☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ > 25

7) Does an ERP system handle all your global information requirements?

☐ Yes ☐ No

[1] Strategic business unit is a small business unit in a company/organisation.

8) If your answer for question 7 is no, please list other information systems used to manage global information needs.

………………………

………………………

………………………

9) What is the country of ownership of your company?

□ Asia □ Australia □ USA □ Japan □ Europe □Other (please specify) ……………..

10) In which countries do you have global business operations?

………………………

………………………

………………………

11) In which country is your business unit located?

………………………

………………………

………………………

12) Which industry group does your organisation belong to?

□ Manufacturing □ Mining

□ Trading □ Finance and insurance

□ Agriculture, forestry and fishing □ Real estate

□ Construction □ Services

□ Transportation □ Gas and Electricity

□ Communications □ Other (please specify) ………………….

13) What was the annual turnover of your organisation (multi-country group) in the last financial year (in million (USD)?

□ < 1Mn □ 1-9Mn □ 10-99Mn □ 100-199Mn □ 200-499Mn □ 500-999Mn □ > 1000Mn

14) How many employees does your organisation (multi-country group) have?

□ 0-100 □ 101-200 □ 201-500 □ 501-1000 □ 1001-5000 □ 5001-9999 □ > 10000

15) To which of the following business units do you belong?

□ Business

□ IT

□ Other (Please specify) …………………

16) What is your position in your organisation?

□ CEO

□ CIO

□ General Manager

□ Senior Manager

□ Department Manager (Please indicate your department) ……………………………………..

□ Junior Manager

□ Other (Please specify your position) ………………………………………………………….

Section B: Global Business Information Requirements

The following questions are intended to determine global business information requirements supported by ERP systems.

Please indicate the extent to which you agree or disagree with the following statements by selecting the appropriate number from "0" to "5", where "0" indicates "not applicable", "1" indicates, "strongly disagree" and "5" indicates "strongly agree".

	Not Applicable	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	0	1	2	3	4	5
1. Real-time information from all business units is required for decision making at the head office						
2. Real-time information from all functional departments is required for decision making at SBUs						
3. Information requirements of the top management are different from that of middle and operational management						
4. Information requirements of the middle management are different from that of top and operational management						
5. Information requirements of non-managerial employees are different to the managerial employees						
6. Detailed as well as summarised information from different business functions is required for quick decision making						
7. Independent information from different SBUs is						

required for decision making						
8. Real time information is required for legal reporting requirements in different countries						
9. Real time information is required for tax payment needs in different countries						
10. Real-time information is required to maintain a strong relationship with investors in different countries						
11. Real-time production related information is required for production planning						
12. Real-time inventory information is important for inventory management in different SBUs						
13. Real-time sales information is important for revenue management and marketing						
14. Real-time spending information is important for cash flow planning						
15. Consolidated information is important for managing business operations effectively						
16. Consolidated information on different issues is required for decision making						
17. Consolidated information is required for foreign exchange management						
18. Consolidated information is critical for planning						
19. Consolidated information is critical for budgeting						
20. Integrated information is required for coordinating production processes on a global basis						
21. Integrated information is required for managing inventory on a global basis						
22. Integrated information is required for coordinating procurement on a global basis						
23. Integrated information is required for managing finance and accounting functions on a global basis						
24. Integrated information is required for managing human resources on a global basis.						
25. Integrated information is required for collaborating with global supply chain partners						
26. Integrated information is necessary for global project management						
27. Real-time information sharing with supply chain partners is critical for improved operational efficiency						
28. Real-time information sharing with supply chain partners is critical for delivering better service to customers						
29. Timely and accurate information exchange with supply chain partners is important to minimize inventory levels						

30. Timely and accurate information exchange with supply chain partners is important to optimize production process						
31. Timely and accurate information exchange with supply chain partners is important to reduce cost associated with supply chain activities						
32. Information security is important to combat unauthorised access						
33. For secure information exchange the organization has adequate information security policies in place						
34. Information security controls (Eg: password, firewall, antivirus software, data encryption and disaster recovery procedure) are essential for information management						
35. Information security policies, procedures and controls are regularly reviewed and updated						

Section C: Capabilities of ERP Systems.

The following questions are intended to determine ERP systems capabilities that are important in managing information requirements of global businesses.

Please indicate the extent to which your organisation's ERP systems have supported to each of the following information requirements by selecting the appropriate number from "0" to "5", where "0" indicates "not applicable", "1" indicates "least extent" and "5" indicates "very great extent".

	Not Applicable	**Least Extent**		**Neutral**		**Great Extent**
	0	1	2	3	4	5
1. Real-time information requirements of the head office are supported by ERP system						
2. Real-time information requirements of SBUs are supported by ERP system						
3. Information requirements of the top management are supported by ERP system						
4. Information requirements of the middle management are supported by ERP system						
5. Information requirements of non-managerial employees are supported by ERP system						
6. Detailed as well as summarised information required for decision making are provided by ERP system						
7. Independent information required for decision making is provided by ERP system						
8. Real time information required for legal reporting requirements in different countries is supported by						

ERP system						
9. Real time information required for tax payment needs in different countries is supported by ERP system						
10. Real-time information required for maintaining a strong relationship with investors in different countries is supported by ERP system						
11. Real-time production related information required for production planning is supported by ERP system						
12. Real-time inventory information required for inventory management in different SBUs is supported by ERP system						
13. Real-time sales information required for revenue management and marketing is supported by ERP system						
14. Real-time spending information required for cash flow planning is supported by ERP system						
15. Consolidated information required for managing business operations is supported by ERP system						
16. Consolidated information required for decision making is supported by ERP system						
17. Consolidated information required for foreign exchange management is supported by ERP system						
18. Consolidated information required for planning is supported by ERP system						
19. Consolidated information required for budgeting is supported by ERP system						
20. Integrated information required for coordinating production processes on a global basis is supported by ERP system						
21. Integrated information required for managing inventory on a global basis is supported by ERP system						
22. Integrated information required for coordinating procurement on a global basis is supported by ERP system						
23. Integrated information required for managing finance and accounting functions on a global basis is supported by ERP system						
24. Integrated information required for managing human resources on a global basis is supported by ERP system						
25. Integrated information required for collaborating with global supply chain partners is supported by ERP system						
26. Integrated information required for global project management is supported by ERP system						

27. Real-time information sharing with supply chain partners is supported by ERP system						
28. Information security control (Eg: password, firewall, antivirus software, data encryption and disaster recovery procedure) initiatives are supported by ERP system						

Section D: Global Business Performance

The following questions are to establish the performance of your global business supported by ERP system.

Please indicate the extent to which ERP systems have contributed to each of the following performance indicators of your organisation by selecting the appropriate number from "0" to "5", where "0" indicates "not applicable", "1" indicates "least extent" and "5" indicates "very great extent".

	Not Applicable	**Least Extent**		**Neutral**		**Great Extent**
	0	1	2	3	4	5
1. Increased return on investment						
2. Increased sales revenue						
3. Reduced operational costs						
4. Enhanced company image/reputation						
5. Increased customer satisfaction						
6. Improved supplier relationship management						
7. Enhanced employee satisfaction						
8. Improved innovation capabilities						
9. Enhanced market share						
10. Better inventory management						
11. Reduction in waste (raw material and finish goods)						
12. Improved quality of products and services						
13. Improved organizational productivity						
14. Improved operational efficiency						

Thank you again for your participation in the survey.

Your contribution for my research project is highly appreciated.

Should you have any question regarding the survey, please contact me on:

Tel: + (61 3) 9925 5801

Email: rajapaksha.rajapaksha@rmit.edu.au

If you would like a summary of my findings, please provide with me your details below:

Name: …………………………………………………………………………………

Email: …………………………………………………………………………………

B.3. Letter of Invitation

RMIT University

Error! Unknown document property name.
School of Business Information Technology & Logistics

Building 108, Level 17
239 Bourke St
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Australia

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. +61 3 9925 5801
Fax +61 3 9925 5850
www.rmit.edu.au

Dear Sir/Madam,

I am conducting a survey to investigate performance impact of aligning enterprise resource planning (ERP) systems with information requirements of global businesses. You have been approached to participate in this research project because you have been identified as a manager/executive who has ERP experience in a global business background.

If you decide to participate in this research project, please click on this link to complete the online version of the survey: https://www.surveymonkey.com/s/KSVPK55

Thank you in advance for your participation in this research project. I would be grateful if you could circulate this survey among other managers in your organisation, friends and relatives who have ERP experience in a global business background.

Please kindly read the attached information sheet carefully before deciding to participate.

Your answers will be completely confidential. If you have any queries about the survey please do not hesitate to contact me.

Yours faithfully,

Manjula Rajapaksha
School of Business Information Technology and Logistics
RMIT University
Melbourne, Australia
Tel: + (61 3) 9925 5801
Fax: + (61 3) 9925 5850
Email: rajapaksha.rajapaksha@rmit.edu.au

B.4. Plain Language Statement

RMIT University

Error! Unknown document property name.
School of Business Information Technology & Logistics

Building 108, Level 17
239 Bourke St
Error! Unknown document property name.
Australia

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. +61 3 9925 5801
Fax +61 3 9925 5850
www.rmit.edu.au

Dear Sir/ Madam,

<u>Invitation to Participate in a Research Project</u>

<u>Project Title: Aligning ERP Systems to Global Business Information Requirements</u>

I sincerely invite you to participate in my research project, which is being conducted as a part of my PHD degree at RMIT University under the supervision of Professor Mohini Singh and Dr. Say Yen Teoh. This information sheet describes the project in straightforward language, or 'plain English'. Please kindly read this information sheet carefully and understand its contents before deciding to participate.

The aim of this research is to understand how alignment of enterprise resource planning (ERP) systems and global business information requirements influences business performances of global business. You are approached because you have been identified as a manager/executive who is managing an organization using ERP system to support global business operations. Your participation will provide useful insight into issues pertaining to alignment of ERP systems to Global Business Information Requirements. The findings of the research will help global businesses to better utilize ERP systems, which are very large investments, and essential for global operations. You may also implement the findings in your organization. Upon your request, a summary of findings of the study will be sent to you.

This survey will take approximately 20 minutes to complete. Your participation in this research is voluntary and there are no perceived risks associated with it. However, if you are concerned about your responses to any of the questions of the survey or if you find that participation in the research project distressing, you may opt to withdraw at any time. Information collected will be kept confidential and participant's anonymity will be ensured at all times. The results of the data collected will be analysed for the completion of the PhD thesis. If you decide to participate in this research project, please click on this link to complete the online version of the survey: https://www.surveymonkey.com/s/KSVPK55

This research project has been approved by the RMIT Human Research Ethics Committee and adheres to the strict guidelines set by the Ethics Committee. Any information provided by the participant would be safe guarded and the security of the data is assured during and after the completion of the study. If you have any inquiries about the survey, you can contact myself, Manjula Rajapaksha by rajapaksha.rajapaksha@rmit.edu.au, or directly contact the Secretary, Portfolio Human Research Ethics Sub Committee, Business Portfolio, RMIT University on telephone: +(61 3) 9925 5594 or email: rdu@rmit.edu.au.

Users should be aware that the World Wide Web is an insecure public network that gives rise to the potential risk that a user's transactions are being viewed, intercepted or modified by third parties or that data which the user downloads may contain computer viruses or other defects. This project will use an external site to create, collect and analyze data collected in a survey format. The site we are using is SurveyMonkey.com. If you agree to participate in this survey, the responses you provide to the survey will be stored on a host server that is used by SurveyMonkey.com. No personal information will be collected in the survey so none will be stored as data. Once we have completed our data collection and analysis, we will import the data we collect to the RMIT server where it will be stored securely for a period of five (5) years. The data on the SurveyMonkey.com host server will then be deleted and expunged.

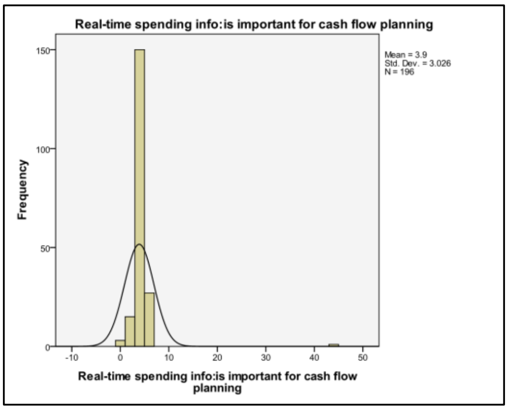
Thank you very much for your support to my research project.

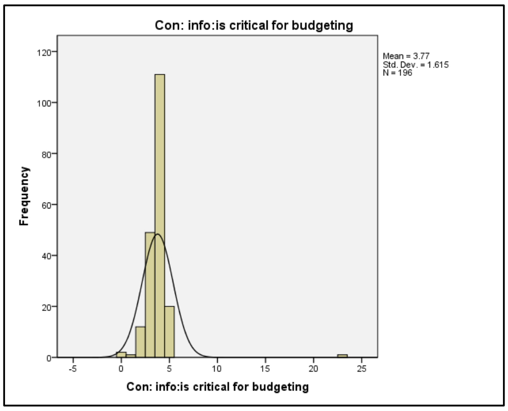
Yours faithfully,

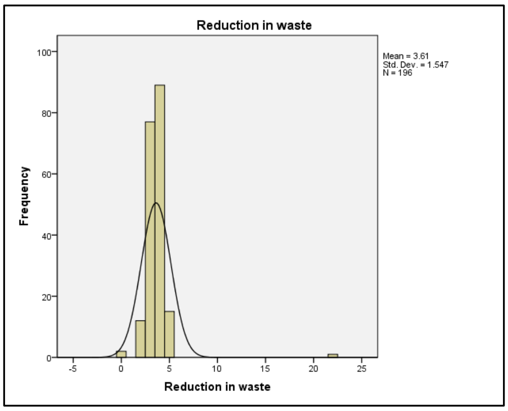
Manjula Rajapaksha
School of Business Information Technology and Logistics
RMIT University
Tel: + (61 3) 9925 5801
Fax: + (61 3) 9925 5850
Email: rajapaksha.rajapaksha@rmit.edu.au

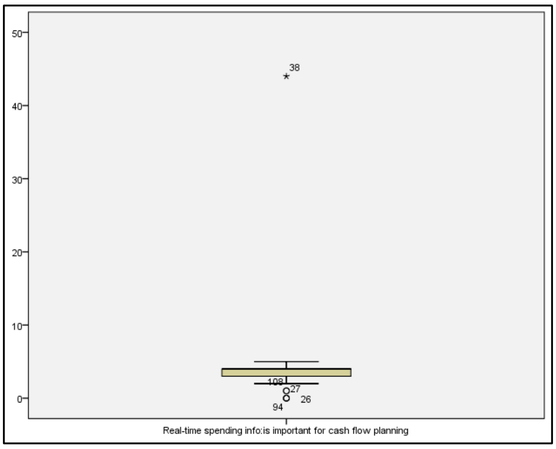
Any complaints about your participation in this project may be directed to the Secretary, Portfolio Human Research Ethics Sub Committee, Business Portfolio, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is +61 3 9925 5594 or email address rdu@rmit.edu.au. Details of the complaints procedure are available from the above address or http://www.rmit.edu.au/council/hrec

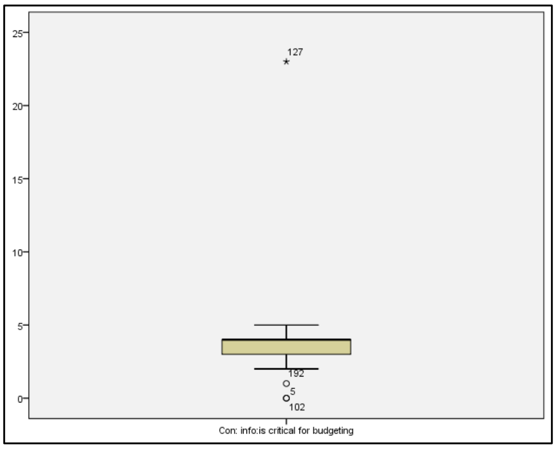
Appendix C: Frequency Distributions and Box Plots of Outliers








38
108
27
26
94
Real-time spending info:is important for cash flow planning


127
192
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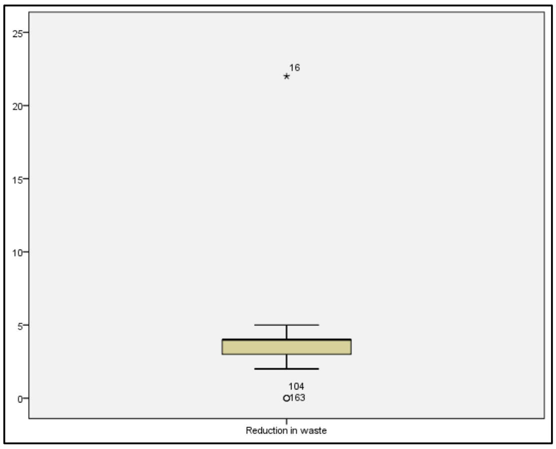
102
Con: info:is critical for budgeting


16
104
163
Reduction in waste

Appendix D: Statistical Tests of Normality

D.1. Analysis of Kurtosis, Skewness, Kolmogorov-Smirnov and Shapiro-Wilk

Tests of Normality										
Item	Kolmogorov-Smirnova			Shapiro-Wilk			Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
	Statistic	df	Sig.	Statistic	df	Sig.				
MLIN_1	.244	196	.000	.872	196	.000	-0.583	0.174	0.950	0.346
MLIN_2	.242	196	.000	.878	196	.000	-0.253	0.174	-0.111	0.346
MLIN_3	.264	196	.000	.834	196	.000	-0.044	0.174	-0.299	0.346
MLIN_4	.249	196	.000	.867	196	.000	-0.638	0.174	0.763	0.346
MLIN_5	.294	196	.000	.851	196	.000	-0.605	0.174	0.380	0.346
MPIN_1	.248	196	.000	.879	196	.000	-0.450	0.174	-0.141	0.346
MPIN_2	.237	196	.000	.882	196	.000	-0.716	0.174	0.819	0.346
MPIN_3	.228	196	.000	.879	196	.000	-0.490	0.174	1.070	0.346
MPIN_4	.231	196	.000	.882	196	.000	-0.486	0.174	0.613	0.346
MPIN_5	.255	196	.000	.835	196	.000	-0.422	0.174	1.244	0.346
ATIN_1	.240	196	.000	.883	196	.000	-0.415	0.174	0.048	0.346
ATIN_2	.216	196	.000	.883	196	.000	-0.460	0.174	0.648	0.346
ATIN_3	.238	196	.000	.876	196	.000	-0.306	0.174	0.109	0.346
ATIN_4	.317	196	.000	.809	196	.000	-1.306	0.174	2.966	0.346
CIN_1	.235	196	.000	.879	196	.000	-0.401	0.174	0.501	0.346
CIN_2	.215	196	.000	.883	196	.000	-0.501	0.174	0.685	0.346
CIN_3	.227	196	.000	.882	196	.000	-0.170	0.174	-0.249	0.346
CIN_4	.235	196	.000	.884	196	.000	-0.499	0.174	0.559	0.346
CIN_5	.323	196	.000	.806	196	.000	-1.189	0.174	2.972	0.346
GBPIN_1	.305	196	.000	.803	196	.000	0.040	0.174	-0.179	0.346
GBPIN_2	.230	196	.000	.877	196	.000	-0.544	0.174	0.803	0.346
GBPIN_3	.240	196	.000	.888	196	.000	-0.702	0.174	-0.048	0.346
GBPIN_4	.252	196	.000	.876	196	.000	-0.689	0.174	0.816	0.346
GBPIN_5	.220	196	.000	.894	196	.000	-0.345	0.174	-0.111	0.346
GBPIN_6	.248	196	.000	.868	196	.000	-0.437	0.174	0.235	0.346
GBPIN_7	.216	196	.000	.868	196	.000	-0.737	0.174	1.342	0.346
GSCIN_1	.247	196	.000	.880	196	.000	-0.519	0.174	0.547	0.346
GSCIN_2	.235	196	.000	.883	196	.000	-0.427	0.174	0.061	0.346
GSCIN_3	.229	196	.000	.882	196	.000	-0.498	0.174	0.679	0.346
GSCIN_4	.261	196	.000	.858	196	.000	-0.213	0.174	0.034	0.346
GSCIN_5	.294	196	.000	.844	196	.000	-0.854	0.174	1.414	0.346
SIN_1	.258	196	.000	.842	196	.000	-0.958	0.174	1.633	0.346
SIN_2	.273	196	.000	.849	196	.000	-1.021	0.174	1.004	0.346
SIN_3	.268	196	.000	.846	196	.000	-1.033	0.174	0.838	0.346
SIN_4	.280	196	.000	.843	196	.000	-1.059	0.174	1.271	0.346

SMLIN_1	.251	196	.000	.865	196	.000	-0.420	0.174	0.563	0.346
SMLIN_2	.239	196	.000	.878	196	.000	-0.161	0.174	-0.408	0.346
SMLIN_3	.220	196	.000	.902	196	.000	-0.619	0.174	-0.114	0.346
SMLIN_4	.215	196	.000	.884	196	.000	-0.322	0.174	0.517	0.346
SMLIN_5	.233	196	.000	.876	196	.000	-0.630	0.174	0.621	0.346
SMPIN_1	.234	196	.000	.876	196	.000	-0.204	0.174	-0.080	0.346
SMPIN_2	.211	196	.000	.888	196	.000	-0.250	0.174	0.170	0.346
SMPIN_3	.195	196	.000	.915	196	.000	-0.524	0.174	-0.340	0.346
SMPIN_4	.228	196	.000	.879	196	.000	-0.431	0.174	0.267	0.346
SMPIN_5	.251	196	.000	.845	196	.000	-0.823	0.174	1.594	0.346
DATIN_1	.219	196	.000	.886	196	.000	-0.331	0.174	0.338	0.346
DATIN_2	.237	196	.000	.880	196	.000	-0.344	0.174	0.235	0.346
DATIN_3	.232	196	.000	.876	196	.000	-0.405	0.174	0.682	0.346
DATIN_4	.236	196	.000	.826	196	.000	-0.907	0.174	2.266	0.346
DCIN_1	.244	196	.000	.873	196	.000	-0.388	0.174	0.483	0.346
DCIN_2	.258	196	.000	.862	196	.000	-0.658	0.174	1.057	0.346
DCIN_3	.240	196	.000	.869	196	.000	-0.076	0.174	-0.534	0.346
DCIN_4	.242	196	.000	.874	196	.000	-0.640	0.174	0.846	0.346
DCIN_5	.230	196	.000	.869	196	.000	-0.578	0.174	0.637	0.346
IGBPIN_1	.257	196	.000	.856	196	.000	-0.470	0.174	0.933	0.346
IGBPIN_2	.263	196	.000	.877	196	.000	-0.595	0.174	0.451	0.346
IGBPIN_3	.211	196	.000	.899	196	.000	-0.671	0.174	-0.152	0.346
IGBPIN_4	.265	196	.000	.869	196	.000	-0.539	0.174	0.555	0.346
IGBPIN_5	.240	196	.000	.861	196	.000	-0.778	0.174	0.953	0.346
MGSCIN_1	.209	196	.000	.883	196	.000	-0.432	0.174	0.722	0.346
MGSCIN_2	.240	196	.000	.881	196	.000	-0.310	0.174	-0.049	0.346
MGSCIN_3	.232	196	.000	.890	196	.000	-0.438	0.174	0.259	0.346
TSIN_1	.215	196	.000	.885	196	.000	-0.369	0.174	0.499	0.346
FINP_1	.246	196	.000	.846	196	.000	-0.407	0.174	1.306	0.346
FINP_2	.260	196	.000	.865	196	.000	-0.742	0.174	1.054	0.346
FINP_3	.258	196	.000	.846	196	.000	-0.645	0.174	1.616	0.346
CUSP_1	.230	196	.000	.865	196	.000	-0.820	0.174	1.187	0.346
CUSP_2	.207	196	.000	.891	196	.000	-0.241	0.174	0.086	0.346
CUSP_3	.265	196	.000	.852	196	.000	-0.857	0.174	1.447	0.346
LGP_1	.229	196	.000	.859	196	.000	-0.381	0.174	1.146	0.346
LGP_2	.235	196	.000	.868	196	.000	-0.625	0.174	1.312	0.346
LGP_3	.225	196	.000	.880	196	.000	-0.250	0.174	0.472	0.346
IBPP_1	.248	196	.000	.795	196	.000	-1.421	0.174	2.384	0.346
IBPP_2	.257	196	.000	.832	196	.000	-0.784	0.174	2.459	0.346
IBPP_3	.258	196	.000	.836	196	.000	-0.451	0.174	1.639	0.346
IBPP_4	.257	196	.000	.847	196	.000	-0.475	0.174	1.217	0.346
IBPP_5	.254	196	.000	.846	196	.000	0.101	0.174	-0.359	0.346

D.2. Analysis of Mean, Median, Mode, Minimum and Maximum

Item	Mean	Std. Error of Mean	Median	Mode	Std. Deviation	Variance	Minimum	Maximum
MLIN_1	3.53	0.06	4.00	4.00	0.89	0.79	0	5
MLIN_2	3.50	0.06	4.00	4.00	0.85	0.72	1	5
MLIN_3	3.38	0.05	3.00	3.00	0.72	0.51	2	5
MLIN_4	3.38	0.06	3.00	4.00	0.88	0.78	0	5
MLIN_5	3.56	0.06	4.00	4.00	0.84	0.70	1	5
MPIN_1	3.34	0.07	3.00	4.00	0.92	0.84	1	5
MPIN_2	3.36	0.07	3.50	4.00	1.01	1.01	0	5
MPIN_3	3.29	0.07	3.00	3.00	0.92	0.84	0	5
MPIN_4	3.45	0.06	4.00	4.00	0.91	0.82	0	5
MPIN_5	3.34	0.05	3.00	3.00	0.75	0.56	0	5
ATIN_1	3.44	0.06	4.00	4.00	0.91	0.82	1	5
ATIN_2	3.40	0.06	3.00	3.00	0.91	0.83	0	5
ATIN_3	3.48	0.06	4.00	4.00	0.85	0.72	1	5
ATIN_4	3.69	0.07	4.00	4.00	0.93	0.87	0	5
CIN_1	3.48	0.06	4.00	4.00	0.89	0.78	0	5
CIN_2	3.39	0.07	3.00	3.00	0.92	0.84	0	5
CIN_3	3.41	0.06	3.00	3.00	0.86	0.74	1	5
CIN_4	3.48	0.07	4.00	4.00	0.92	0.85	0	5
CIN_5	3.66	0.06	4.00	4.00	0.85	0.72	0	5
GBPIN_1	3.36	0.05	3.00	3.00	0.65	0.43	2	5
GBPIN_2	3.43	0.06	3.00	4.00	0.90	0.81	0	5
GBPIN_3	2.97	0.09	3.00	3.00	1.21	1.46	0	5
GBPIN_4	3.42	0.07	4.00	4.00	0.96	0.91	0	5
GBPIN_5	3.42	0.07	3.00	4.00	0.95	0.90	1	5
GBPIN_6	3.15	0.06	3.00	3.00	0.86	0.74	1	5
GBPIN_7	3.45	0.07	3.50	3.00	0.96	0.92	0	5
GSCIN_1	3.53	0.07	4.00	4.00	0.91	0.83	0	5
GSCIN_2	3.40	0.07	3.00	4.00	0.91	0.84	1	5
GSCIN_3	3.51	0.07	4.00	4.00	0.91	0.84	0	5
GSCIN_4	3.60	0.06	4.00	4.00	0.78	0.61	1	5
GSCIN_5	3.57	0.06	4.00	4.00	0.87	0.75	0	5
SIN_1	3.22	0.07	3.00	3.00	0.93	0.86	0	5
SIN_2	3.04	0.08	3.00	3.00	1.12	1.26	0	5
SIN_3	3.05	0.08	3.00	3.00	1.14	1.31	0	5
SIN_4	3.10	0.08	3.00	3.00	1.12	1.26	0	5

SMLIN_1	3.44	0.06	4.00	4.00	0.84	0.71	0	5
SMLIN_2	3.46	0.06	4.00	4.00	0.86	0.73	1	5
SMLIN_3	3.10	0.09	3.00	4.00	1.24	1.54	0	5
SMLIN_4	3.46	0.06	3.00	3.00	0.90	0.81	0	5
SMLIN_5	3.27	0.07	3.00	4.00	0.93	0.87	0	5
SMPIN_1	3.46	0.06	3.00	4.00	0.84	0.70	1	5
SMPIN_2	3.38	0.06	3.00	3.00	0.91	0.82	0	5
SMPIN_3	2.94	0.10	3.00	3.00	1.34	1.81	0	5
SMPIN_4	3.44	0.06	3.00	4.00	0.90	0.81	1	5
SMPIN_5	3.36	0.06	3.00	4.00	0.86	0.73	0	5
DATIN_1	3.50	0.06	4.00	4.00	0.91	0.83	0	5
DATIN_2	3.50	0.06	4.00	4.00	0.90	0.81	0	5
DATIN_3	3.53	0.06	4.00	4.00	0.87	0.76	0	5
DATIN_4	3.33	0.06	3.00	3.00	0.82	0.67	0	5
DCIN_1	3.51	0.06	4.00	4.00	0.87	0.75	0	5
DCIN_2	3.47	0.06	4.00	4.00	0.87	0.75	0	5
DCIN_3	3.52	0.06	4.00	4.00	0.83	0.69	2	5
DCIN_4	3.46	0.07	4.00	4.00	0.92	0.84	0	5
DCIN_5	3.24	0.06	3.00	4.00	0.90	0.81	0	5
IGBPIN_1	3.48	0.06	4.00	4.00	0.81	0.66	0	5
IGBPIN_2	3.48	0.07	4.00	4.00	0.93	0.87	0	5
IGBPIN_3	3.10	0.09	3.00	4.00	1.29	1.66	0	5
IGBPIN_4	3.49	0.06	4.00	4.00	0.88	0.77	0	5
IGBPIN_5	3.28	0.07	3.00	4.00	0.91	0.84	0	5
MGSCIN_1	3.49	0.07	4.00	3.00	0.94	0.89	0	5
MGSCIN_2	3.48	0.06	4.00	4.00	0.87	0.76	1	5
MGSCIN_3	3.42	0.07	3.50	4.00	0.94	0.88	0	5
TSIN_1	3.48	0.06	3.50	3.00	0.91	0.83	0	5
FINP_1	3.49	0.06	4.00	4.00	0.78	0.61	0	5
FINP_2	3.51	0.07	4.00	4.00	0.91	0.84	0	5
FINP_3	3.52	0.06	4.00	4.00	0.81	0.66	0	5
CUSP_1	3.38	0.07	3.00	4.00	0.97	0.93	0	5
CUSP_2	3.42	0.07	3.00	3.00	0.93	0.86	0	5
CUSP_3	3.42	0.06	4.00	4.00	0.90	0.81	0	5
LGP_1	3.52	0.06	4.00	3.00	0.83	0.68	0	5
LGP_2	3.46	0.06	4.00	4.00	0.90	0.80	0	5
LGP_3	3.39	0.06	3.00	3.00	0.87	0.76	0	5
IBPP_1	3.33	0.08	4.00	4.00	1.11	1.24	0	5
IBPP_2	3.51	0.06	4.00	4.00	0.81	0.66	0	5
IBPP_3	3.56	0.05	4.00	4.00	0.77	0.59	0	5
IBPP_4	3.49	0.06	4.00	4.00	0.79	0.62	0	5
IBPP_5	3.57	0.05	4.00	3.00	0.75	0.56	2	5

Appendix E: List of Countries (Global Businesses are Operating)

List of countries where these businesses are operating				
	Country	**Frequency**	**Percent**	**Cumulative Percent**
1	India	62	10.20	10.20
2	Sri Lanka	59	9.70	19.90
3	Malaysia	52	8.55	28.45
4	Indonesia	41	6.74	35.20
5	Singapore	39	6.41	41.61
6	China	33	5.43	47.04
7	UK	32	5.26	52.30
8	Over 10 countries	27	4.44	56.74
9	Dubai	25	4.11	60.86
10	USA	23	3.78	64.64
11	Australia	22	3.62	68.26
12	Saudi Arabia	21	3.45	71.71
13	Qatar	19	3.13	74.84
14	New Zealand	17	2.80	77.63
15	Fiji	10	1.64	79.28
16	France	9	1.48	80.76
17	Pakistan	9	1.48	82.24
18	Africa	8	1.32	83.55
19	Canada	8	1.32	84.87
20	Italy	8	1.32	86.18
21	Over 200 countries	7	1.15	87.34
22	Zambia	7	1.15	88.49
23	Bahrain	6	0.99	89.47
24	Japan	6	0.99	90.46
25	Bangladesh	5	0.82	91.28
26	Germany	5	0.82	92.11
27	Korea	5	0.82	92.93
28	Taiwan	4	0.66	93.59
29	Vietnam	4	0.66	94.24
30	Finland	3	0.49	94.74
31	Maldives	3	0.49	95.23
32	Middle East	3	0.49	95.72
33	Sweden	3	0.49	96.22
34	Cameroon	2	0.33	96.55
35	Cambodia	2	0.33	96.88
36	Ireland	2	0.33	97.20
37	Mexico	2	0.33	97.53
38	Over 100 countries	2	0.33	97.86

39	Thailand	2	0.33	98.19
40	Papua new guinea	2	0.33	98.52
41	Barbados	1	0.16	98.68
42	Belgium	1	0.16	98.85
43	Brazil	1	0.16	99.01
44	Hawaii	1	0.16	99.18
45	Jamaica	1	0.16	99.34
46	Over 20 countries	1	0.16	99.51
47	Solomon Islands	1	0.16	99.67
48	Vanuatu	1	0.16	99.84
49	Zimbabwe	1	0.16	100.00

Appendix F: Exploratory Factor Analysis (EFA)

F.1. EFA Results of Global business Information Requirements Construct

Item	Component							Commu nalities
	1	2	3	4	5	6	7	
MLIN_1	.841							.747
MLIN_2	.783							.636
MLIN_3		.574		.338				.545
MLIN_4	.720							.587
MLIN_5				.352		.589		.538
MPIN_1		.649						.504
MPIN_2		.733						.589
MPIN_3			.710					.605
MPIN_4		.722						.606
MPIN_5			.808					.753
ATIN_1			.748					.601
ATIN_2			.695					.630
ATIN_3			.749					.590
ATIN_4				.577				.483
CIN_1					.839			.746
CIN_2					.830			.703
CIN_3					.660			.580
CIN_4					.830			.710
CIN_5						.369	.628	.595
GBPIN_1		.656						.622
GBPIN_2			.695	.394				.673
GBPIN_3						.644		.449
GBPIN_4			.661	.447				.674
GBPIN_5			-.504					.395
GBPIN_6					.472	.311		.449
GBPIN_7			.670	.343				.638
GSCIN_1						.804		.687
GSCIN_2						.738		.594
GSCIN_3						.820		.722
GSCIN_4				.789				.651
GSCIN_5				.612		.379		.617
SIN_1					.606			.423
SIN_2					.464			.310
SIN_3					.753			.604
SIN_4							.818	.709

F.2. EFA Results of ERP Systems Capabilities Construct

Item	Component							Communalities
	1	2	3	4	5	6	7	
SMLIN_1	.833							.735
SMLIN_2	.792							.706
SMLIN_3		.474			.571			.718
SMLIN_4	.853							.746
SMLIN_5		.430			-.390			.652
SMPIN_1		.845						.737
SMPIN_2		.823						.707
SMPIN_3			.327	.571		.377	-.501	.881
SMPIN_4		.765						.668
SMPIN_5			.463		-.399	-.325		.674
DATIN_1				.897				.831
DATIN_2				.867				.761
DATIN_3				.744				.584
DATIN_4		.544						.510
DCIN_1			.953					.915
DCIN_2			.861					.755
DCIN_3			.824					.726
DCIN_4			.837					.707
DCIN_5		.348	-.346	.333			.485	.646
IGBPIN_1		-.368					.720	.812
IGBPIN_2		-.334		.338			.577	.718
IGBPIN_3			.688		.371			.717
IGBPIN_4		-.418		.394			.615	.772
IGBPIN_5			.374		-.322	.621	.402	.865
MGSCIN_1						.871		.779
MGSCIN_2						.774		.640
MGSCIN_3						.825		.717
TSIN_1	.830							.699

F.3. EFA Results of Global Business Performance Construct

Item	Component				Communalities
	1	2	3	4	
FINP_1	.743				.686
FINP_2	.483	.573			.585
FINP_3	.742				.607
CUSP_1			.879		.875
CUSP_2		.484	.592		.607
CUSP_3			.768	.351	.733
LGP_1				.734	.649
LGP_2	.401		.369	.474	.523
LGP_3				.727	.621
IBPP_1				.989	.985
IBPP_2		.494	.557		.587
IBPP_3		.540	.612		.666
IBPP_4		.490	.681		.717
IBPP_5		.562	.612		.696

Appendix G: Standardised Residual Covariances

G.1. Global Business Information Requirements Construct

Item	Q-43	Q-44	Q-45	Q-37	Q-39	Q-42	Q-31	Q-32	Q-33	Q-34	Q-27	Q-28	Q-29	Q-22	Q-23	Q-25	Q-17	Q-18	Q-20
Q-43	0.00																		
Q-44	0.20	0.00																	
Q-45	0.30	-0.71	0.00																
Q-37	-0.25	-0.46	-0.64	0.00															
Q-39	-0.18	-0.11	0.04	0.05	0.00														
Q-42	0.31	0.11	0.56	0.05	-0.13	0.00													
Q-31	0.28	0.43	0.26	0.03	0.24	-0.11	0.00												
Q-32	0.04	0.29	0.06	-0.58	-0.65	0.34	-0.47	0.00											
Q-33	-0.74	0.16	-0.20	1.08	0.18	-0.13	0.28	0.06	0.00										
Q-34	-0.53	-0.12	-0.27	-0.30	-0.01	0.04	0.08	0.34	-0.14	0.00									
Q-27	0.03	-0.52	-0.21	-0.09	-0.39	0.06	-0.59	0.46	-0.30	0.06	0.00								
Q-28	0.14	0.13	0.26	0.50	-1.14	-0.65	0.40	-0.35	0.53	-0.24	0.24	0.00							
Q-29	0.32	0.49	0.16	-0.76	0.00	0.06	-0.39	-0.24	-0.50	-0.24	0.06	-0.33	0.00						
Q-22	-0.54	-0.18	0.16	0.59	1.29	-0.63	-0.11	-0.10	0.42	-0.51	0.37	-0.67	-0.20	0.00					
Q-23	0.05	-0.07	0.07	0.09	0.69	-0.74	0.47	0.37	0.24	0.69	-0.17	0.44	-0.42	0.13	0.00				
Q-25	-0.50	0.66	0.08	0.20	1.16	-0.08	0.09	0.54	-0.83	0.21	0.50	-0.13	0.56	0.35	-0.37	0.00			
Q-17	0.08	-0.28	0.00	-0.40	-0.18	0.25	-0.09	0.17	-0.34	0.10	0.03	-0.40	0.09	-0.10	0.17	-0.21	0.00		
Q-18	-0.45	0.31	0.25	-0.19	0.61	0.19	0.13	0.04	0.21	0.34	0.36	-0.02	0.29	-0.43	-0.14	0.70	-0.18	0.00	
Q-20	0.01	0.11	-0.41	-0.95	-0.78	-0.43	0.03	-0.15	0.02	0.30	0.25	0.50	0.08	-1.28	-0.08	-0.69	0.57	-0.70	0.00

G.2. ERP Systems Capabilities Construct

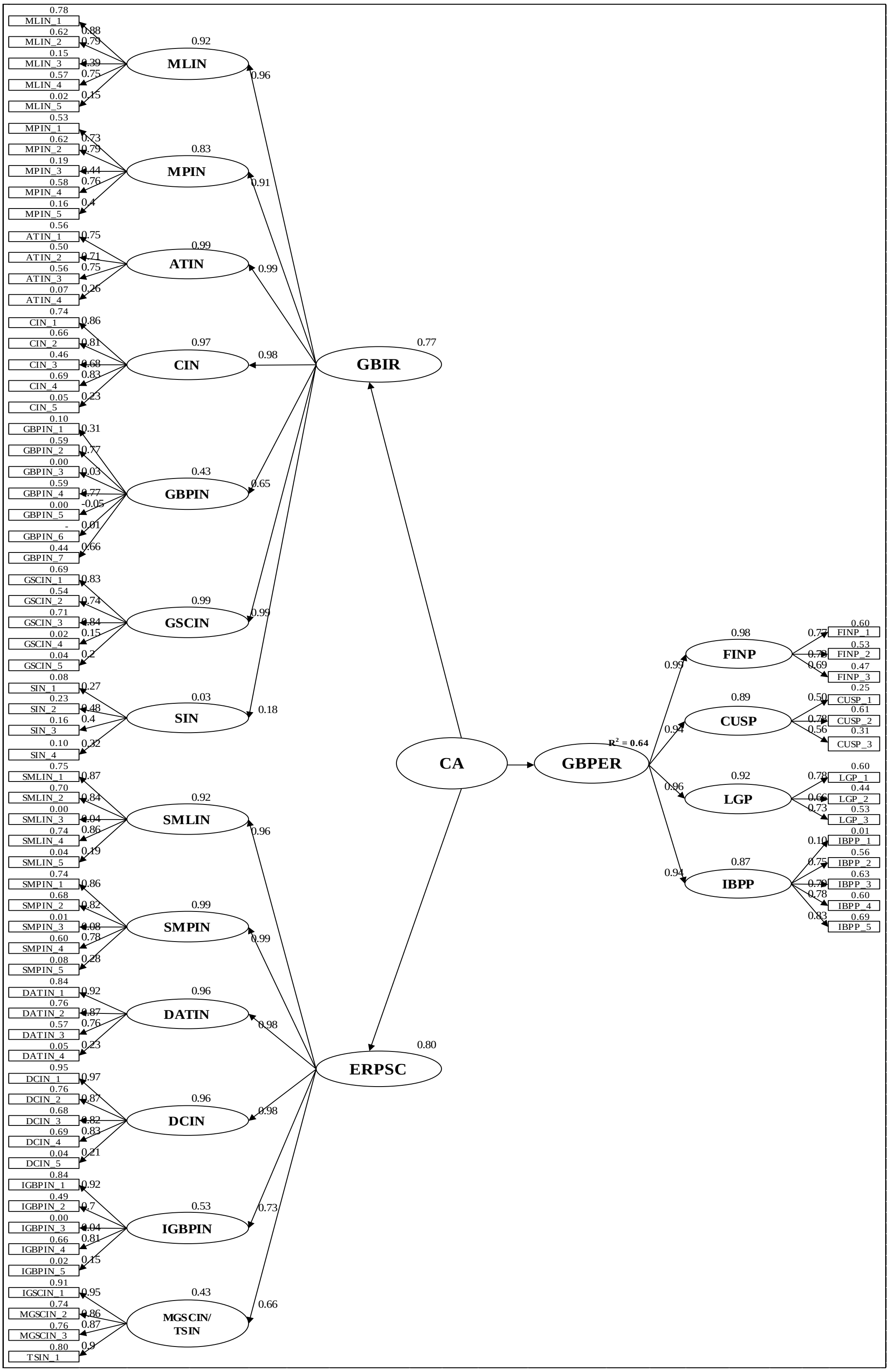
Item	Q -79	Q -78	Q -71	Q -72	Q -74	Q -76	Q -77	Q -66	Q -67	Q -68	Q -69	Q -62	Q -63	Q -64	Q-57	Q-58	Q-60	Q-52	Q-53	Q-55
Q -79	0.00																			
Q -78	-0.23	0.00																		
Q -71	0.35	0.83	0.00																	
Q -72	0.54	0.60	-0.10	0.00																
Q -74	-0.23	0.64	0.03	0.12	0.00															
Q -76	0.16	-0.16	0.51	0.61	-0.33	0.00														
Q -77	0.04	-0.07	0.19	0.71	-0.37	0.20	0.00													
Q -66	0.08	0.19	0.28	0.51	-0.01	-0.05	-0.20	0.00												
Q -67	-0.04	0.27	0.55	0.48	0.69	-0.22	-0.22	0.07	0.00											
Q -68	0.11	0.34	-0.31	0.46	-0.60	0.13	0.11	-0.05	-0.24	0.00										
Q -69	0.38	0.30	0.38	1.03	0.21	-0.09	0.02	-0.03	0.10	0.01	0.00									
Q -62	-0.04	0.06	-0.58	-0.17	-0.52	0.25	-0.20	0.00	0.12	-0.12	0.02	0.00								
Q -63	0.10	0.42	0.27	0.73	0.02	0.17	-0.26	0.13	-0.25	0.22	-0.18	-0.11	0.00							
Q -64	-0.42	0.13	0.07	0.00	-1.10	0.24	0.32	-0.09	-0.50	0.60	-0.69	0.22	0.02	0.00						
Q-57	-0.66	-0.02	-0.09	-0.49	-0.19	-0.11	-0.34	0.17	0.53	0.37	0.27	0.24	-0.47	0.27	0.00					
Q-58	0.41	-0.23	-0.06	-0.01	-0.70	-0.18	0.26	-0.06	0.20	-0.13	0.15	-0.20	-0.14	-0.34	-0.12	0.00				
Q-60	-0.13	-0.63	-0.70	-0.42	-0.36	-0.45	-0.46	-0.19	-0.28	-0.01	-0.50	0.10	0.06	-0.50	0.01	0.20	0.00			
Q-52	-0.09	-0.23	-0.64	-0.51	-0.45	-0.07	-0.16	-0.09	-0.40	-0.28	-0.02	-0.02	0.18	-0.70	-0.28	0.50	1.28	0.00		
Q-53	-0.46	-0.65	-0.58	-1.13	-0.75	-0.48	-0.08	-0.30	-0.70	-0.21	-0.76	0.01	-0.11	0.03	-0.02	0.15	0.97	0.58	0.00	
Q-55	0.67	0.31	-0.32	0.86	-0.38	0.25	0.40	0.23	-0.12	0.05	0.87	0.31	0.18	-0.41	-0.20	-0.07	-0.07	-0.37	-0.11	0.00

G.3. Global Business Performance Constructs

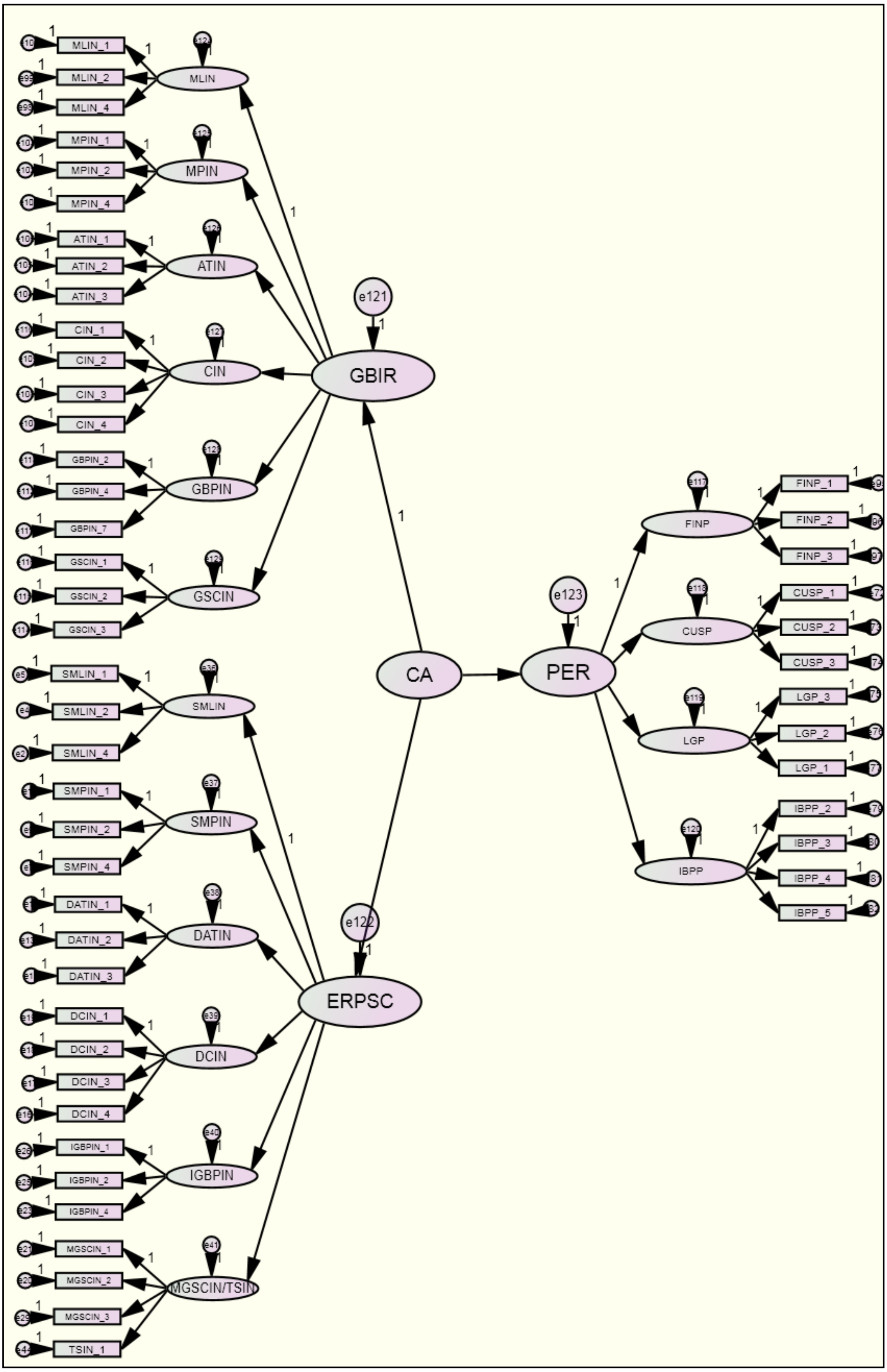
Item	Q -93	Q -92	Q -91	Q -90	Q -86	Q -87	Q -88	Q -85	Q -84	Q -83	Q -81	Q -81	Q -80
Q -93	0.00												
Q -92	0.32	0.00											
Q -91	-0.04	-0.13	0.00										
Q -90	-0.38	0.15	0.08	0.00									
Q -86	-0.50	-0.06	0.25	-0.04	0.00								
Q -87	0.29	0.41	0.69	0.70	-0.14	0.00							
Q -88	-0.01	-0.34	-0.07	0.28	0.59	-0.84	0.00						
Q -85	0.04	0.00	0.32	0.51	-0.90	0.64	-0.39	0.00					
Q -84	0.22	0.66	-0.26	0.19	-0.42	-0.05	-0.36	0.36	0.00				
Q -83	0.06	-1.21	-0.60	0.71	0.16	1.49	0.42	0.32	-0.58	0.00			
Q -81	-0.29	-0.56	-0.26	-0.24	-0.06	-0.04	0.28	-0.74	0.28	-0.37	0.00		
Q -81	0.47	0.22	0.25	-0.19	-0.20	-0.18	0.02	0.58	0.67	0.32	-0.16	0.00	
Q -80	0.02	-0.90	-0.25	-0.06	-0.02	-0.17	0.28	-0.74	-0.02	0.79	0.97	-0.69	0.00

Appendix H: Path Diagrams

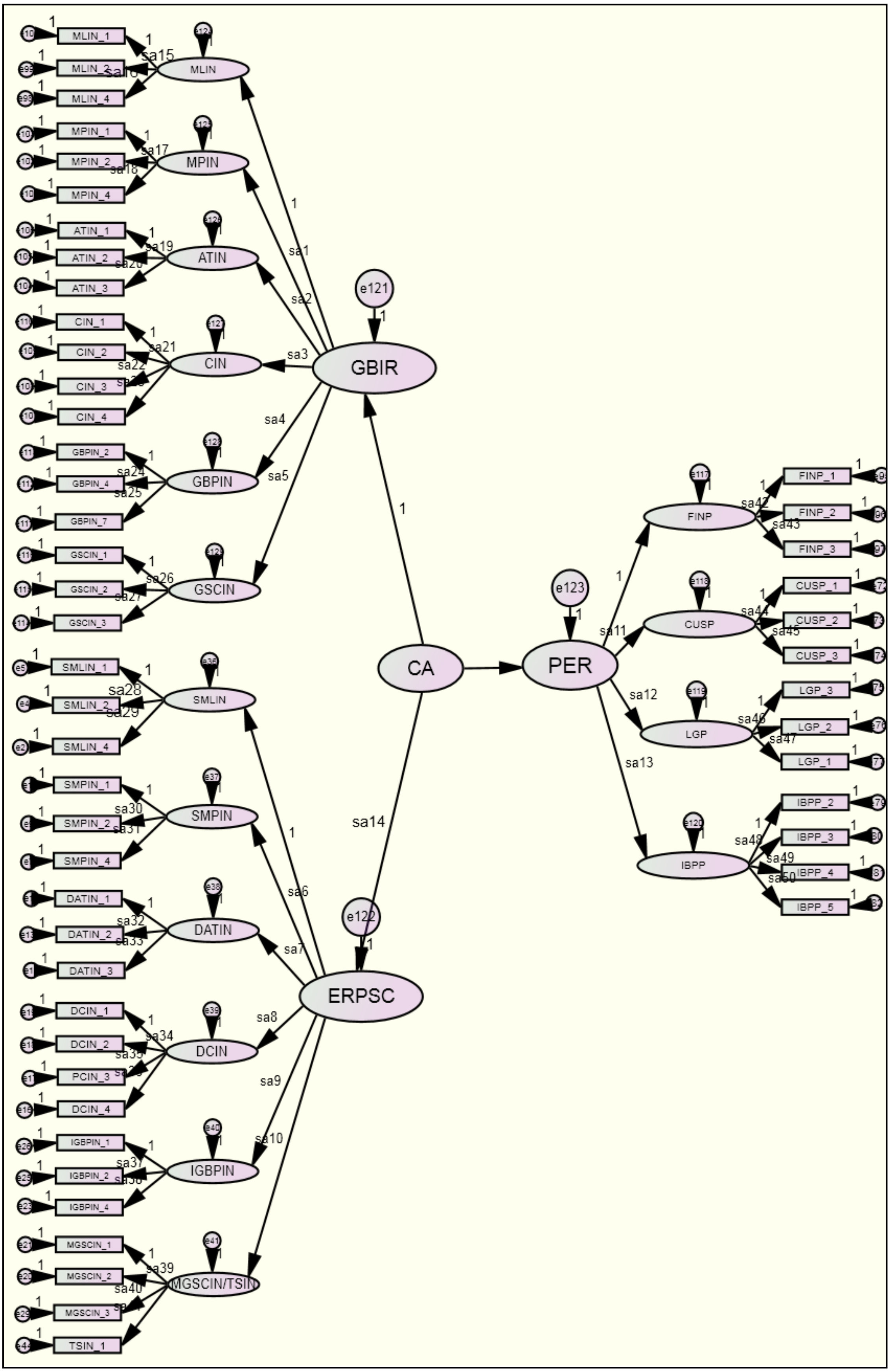
H.1. Initial Full Measurement Model



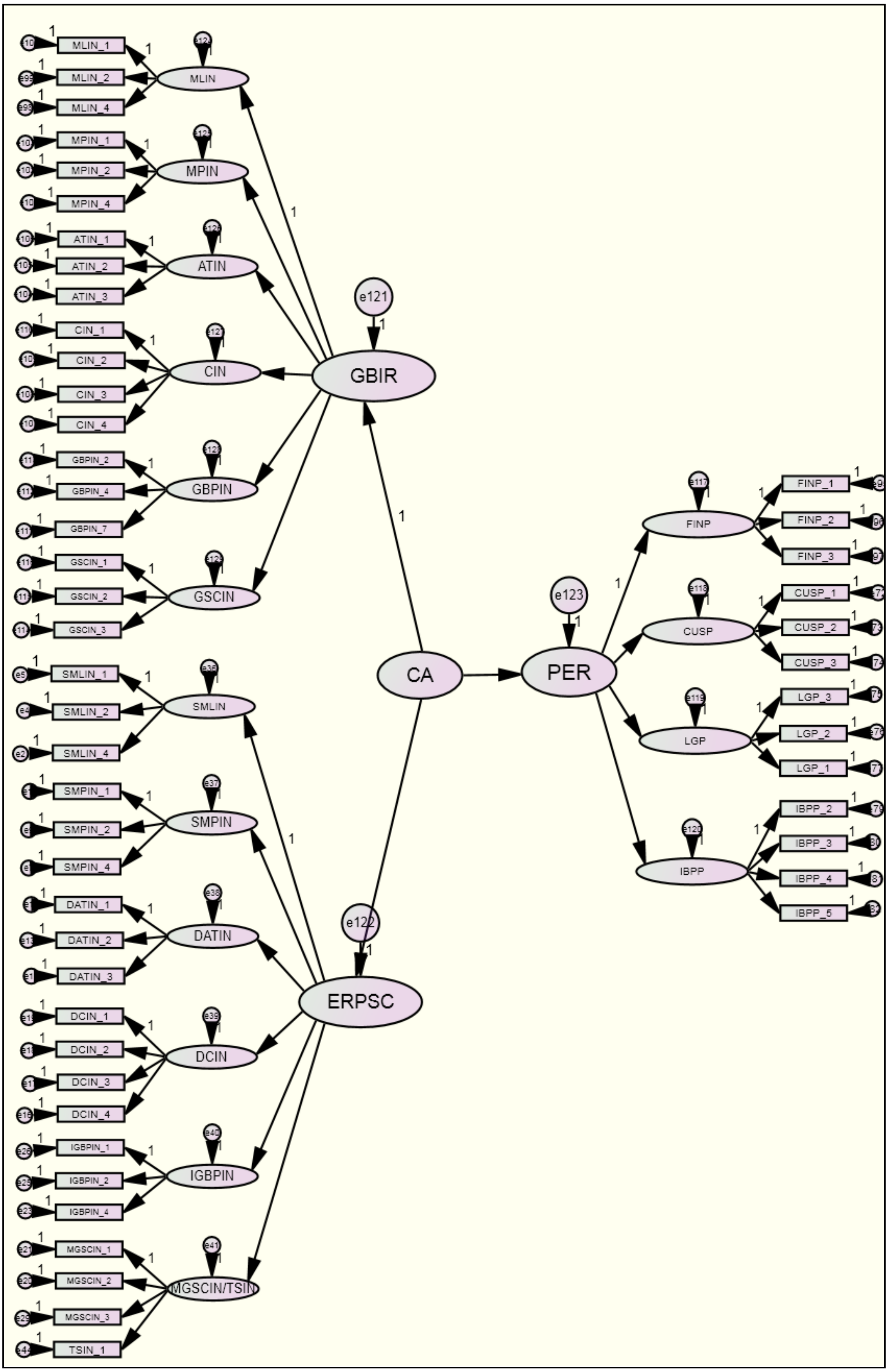
H.2. Path Diagram of TF Model (Organisation Size)



H.3. Path Diagram of Constrained Model (Organisation Size)



H.4. Path Diagram of TF Model (Globalisation History)



H.5. Path Diagram of Constrained Model (Globalisation History)